The Chemical Age

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NOTICES:—All communications relating to editorial matter should be addressed to the Editor who will be pleased to consider articles or contributions dealing with modern chemical developments or suggestions bearing upon the advancement of the chemical industry in this country. Other communications relating to advertisements or general matters should be addressed to the Manager.

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The Sulphate of Ammonia Subsidy

As many of our readers are no doubt aware, the Government subsidy given to producers of sulphate of ammonia during the war has now been withdrawn. At the same time the Board of Agriculture and Fisheries has come to an agreement with makers of the salt as to the maximum prices to be charged for agricultural use in this country. The fixed prices are marked forward until the end of next May, and vary from £20 10s. per ton next month on a gradually increasing scale, so that in March, 1920, the maximum price will be £22 per ton. During the past ten years or so the sulphate of ammonia market has afforded an interesting study, particularly in two directions. In the early years of the present century the price was frequently below £10 per ton at works, while the greater proportion of the salt was readily absorbed by the export trade with such countries as Japan and Spain. In those days, in spite of the activities of the Sulphate of Ammonia Association, it was comparatively difficult to convince the home consumer of the merits of the salt as a fertiliser; and in the selection of nitrogenous plant foods nitrate of soda was usually the first favourite owing to its price being rather less than that of its main competitor. The farmer, perhaps, was not sufficiently technical to appreciate the fact that the cheaper article contained a smaller proportion of the essential element (nitrogen) which he required. With the resources of Chile cut off, however, there was no alternative to the sulphate, and experience with it tends to show that we shall never again export to the tune of the pre-war period.

Perhaps, in view of the demand it is a little discouraging to see that the production of ammonia and its compounds in this country fell off by some 6 per cent. in 1918 as compared with 1917, the difference being ascribed in the main to the poor quality of coal which has been and is still being served out to the carbonizing undertakings. The promise of any increase in production in the near future is not, moreover, very great, for it would seem that the day is not far distant when a so-called "low-grade" gas will be generally distributed by the towns' gas undertakings, and such a policy means that far less coal will be required per volume of gas distributed. Less coal, of course, means less ammonia, unless some method is devised for very substantially increasing the nitrogen of the coal recoverable in the form of ammonia. As an auxiliary source there is always the synthetic product to be considered, but as our policy in this direction appears to be one of continual drift it is difficult for the moment to take it seriously. Even then, although many alluring figures have been given, it is a matter for doubt whether a fertiliser made from the synthetic source could compete with the existing product, even at what appear to be the high prices which the latter is now commanding. In view of the enormous increase in the price of coal, labour, and sulphuric acid, the new maximum prices do not appear to us excessive, and they have been arrived at by what would seem to be fairly equitable commercial reckoning. As a final word, we may draw attention to the fact that not all the producers of sulphate of ammonia are members of the Association, and we believe that they would be serving both their own interests and those of the producers who already belong to it by joining as soon as possible.

Workers and the Technical Press

THE announcement made by Sir John Benn at the annual meeting of Benn Brothers, Ltd. (the publishers of THE CHEMICAL AGE, and several other technical and trade journals), that the workers are giving increased attention to the study of the technical press, is one to be

cordially welcomed. Our commercial representatives abroad from time to time emphasise the advantage over British firms which foreign rivals derive from their more liberal use of trade and technical publications, and of business literature generally. Gradually, if somewhat slowly, it is coming to be recognised that publicity, scientifically directed and applied, is an essential part of the organisation of any really great business, and the increasing use of it made by some of the largest and most prosperous British firms is the best proof that the policy pays. The essence, however, of the success of the policy lies in its being done thoroughly. Casual, intermittent, badly designed advertising is almost, if not quite, useless. Too often it is dropped just when the fruits were about to appear, and the disappointed business man regards advertising as a mistake, when really the fault lies with his own unscientific methods of advertising. It is now quite a common practice to leave this work to experts in publicity, and very few concerns which give the system a thorough trial are disposed to go back on it.

If it is good to find the heads of great works recognising the advantage of this wider use of publicity, it is no less welcome to find the workers, especially in the technical industries, taking a keener interest in the study of technical and scientific problems, and, indeed, in the commercial aspects of their particular trade. Wise employers will give every encouragement to this tendency, as, indeed the most progressive do by encouraging attendance at science classes, and by subscribing for British, American and German technical journals for the use of their works staffs. It may be that the trained and educated workman costs a little more than the untrained and indifferent, but the employer gets the immense advantage of the services of men who really understand their business, and are sufficiently advanced to take a personal interest in the processes and operations they direct. The less imaginative employer sees the objection to paying a rather higher wage to the more highly qualified worker, but overlooks the ultimate advantage to his business, and consequently stands still while more progressive firms go ahead. Sir John Benn's observation of the workman's increased interest in technical publications is no doubt founded on good information derived from the experience of a large publishing house, and it is one of the most hopeful and encouraging signs of advance we have recently noted.

An English Elysium

At the extraordinary general meeting on Monday of English Oilfields (Limited), a report of which is given elsewhere, Dr. Forbes Leslie unfolded a tale of wealth and prosperity which even the most sceptical investor with any balance available at his bank would scarcely be able to resist. In the matter of oil we have suffered a little from premature enthusiasm, such as in the cases, for example, of the famous but fickle Ramsey spouter and the recent riddle of the Norfolk parson who awoke to find his demesne resembling the widow's cruse. Dr. Leslie's facts, however, are made of sterner stuff, and in the country's interest we trust that before long his visions will materialise. As it is, he was only able to give "a brief résumé" of the company's position; for, in his own words, it is not advisable at the moment to deal too explicitly with the knowledge which has been acquired of the value of the property, and its unique features. The company is operating an area of about twenty square miles in Norfolk, and proposes to mine the underlying shale beds, retort the shale, and recover the volatile constituents. The oil obtained from certain of the shales is of remarkable quality, practically free from sulphur, and especially rich in motor spirit and wax. As regards the yield of oil, it is estimated that from 45 to 50 gallons will be obtained per ton of shale, with subsidiary yields of 60 lb. of sulphate of ammonia and 60 lb of wax. The money now asked for is to provide the necessary arrangements to deal with about 2,500 tons of shale per day, so that at this rate we may find our sulphate of ammonia production increased by some 25,000 tons per annum, or about a twentieth of the total output of the whole country.

Such items, however, by no means exhaust the prospective activities of the company, for in addition to shale there is a highly acceptable form of clay in the same area, from which bricks of "quality unsurpassed in England" can be manufactured, not to mention the 600 tons of cement which is daily to be derived from the shale residue. But, lest any misapprehension should arise as to the longevity of the scheme, it should be explained that the company, according to Dr. Leslie, has nothing to fear in the way of exhaustion for at least 120 years, and the shareholders, with all the excitement that the near future promises them, can afford to regard with equanimity so distant a date. Besides, it is quite possible that before then this fertile spot in the Garden of England will provide some further source of encouragement and wealth to compensate its backers.

Raw Material for Germany

It is always interesting to hear reliable views as to the industrial position of Germany during the war, and her possibilities in the near future. A great deal has been written on the subject, both in the daily and in the technical Press, and the opinions given are, in general, of so contradictory a nature as to warrant the suggestion that in many instances the writers are dealing with a subject of which they probably know very little. It is, therefore, all the more refreshing to find Mr. R. D. Zucker giving, in an American contemporary, facts which have been obtained from his personal observations of mail censorship reports of which he prepared daily summaries for several months, and also from his experience in various parts of occupied territory. As is well known, of course, the effect of the war has been to bring about a condition exactly opposite to that which its provokers intended, with the result that the great German industries were more or less brought to a standstill. In fact, Germany's dependence upon other countries for so much of her war material has placed her in a precarious position, as may be judged from the fact that she has no important copper, tin, or nickel deposits. Accordingly, she awaits with eagerness the day when such countries as the United States will be able to export a handsome proportion of their overstock of copper, cotton, rubber, and textiles. At the same

time, it is worth noting that the German industrialists are far more anxious to import the raw products than the finished articles. This is in order that their idle plant may once again be set in motion, and employment found for the number of out-of-works, of whom, in Berlin alone, there are about 200,000.

Of course, Germany is suffering at the moment from the spread of advanced socialism, and from the difficulties in transport resulting from the acute shortage in rolling stock. The Allies denuded her of some 5,000 locomotives, but, as an instance of her spirit, it may be well to remember her boast that she will be able to make good this deficiency in the short space of three months from the spare parts in hand. The majority of factories, in fact, are in a condition to recommence manufacture at short notice, once the influences which were responsible for their closing down are removed. Thus, with a regular coal supply, open lines of transportation, and a more reasonable spirit among the labouring classes, Germany should be able to produce on a scale proportionate to the supply of her own raw materials and the disposal of her goods. She must, however, have raw materials, and as it is to the advantage of the Allied nations, with their big debit account against her, to see her potentialities turned to good account, there should be no hesitation in ensuring that she obtains her requirements in this respect.

Low-Temperature Distillation

A PROCESS for low-temperature carbonisation, which has attracted more or less notice in British Columbia, has been experimented with at Nanaimo under the auspices of the inventor, Mr. Walter Thomas, and a Vancouver firm, Messrs. McPherson & Fullerton Brothers. Originally it was tried on Nicola Valley coal; the products were a semi-coked smokeless fuel, and about 7 gallons of oil per ton of fuel, with little permanent gas. Later work has produced a good dense charcoal from mill waste obtainable for a few cents per cord. In operation, a vertical brick-lined retort some 14 ft. high and $3\frac{1}{2}$ ft. in diameter is filled with coarse material to be carbonised, then closed, and the air contained in the system forced by a fan through a pipe stove and into the top of the retort. This passes down through the mass to be carbonised, thence through a pipe condenser and an electrical precipitator to remove liquid hydrocarbons, and back to the fan for re-circulation. As the carbonised fuel becomes hotter, gases are given off so that after a time the rich products of distillation constitute the circulating medium.

Dr. Stansfield, in his recent report on Electric Smelting of Iron Ore in British Columbia, presents a short note on this process. He sees many drawbacks to the scheme as it was illustrated to him, such as the difficulty of forcing gas through the filled retort, the slow heating of the carbonising mass by the circulating gases, which are of low temperature and low heat capacity, the inefficiency and expense of the ordinary pipe stove, and the decomposition of hydrocarbon which will take place at this point. He has been assured, however, that enough work has been done to convince the supporters of the process that they can make satisfactory charcoal at a cost of about 5 dollars per ton, in a cycle of operations lasting six hours.

British Association Meeting

THE British Association has not met since September of 1916, when the conferences were held at Newcastle-on-Tyne, and so much has happened in the interval that the annual meeting which opens at Bournemouth on Tuesday should be of more than usual interest. The subject of the presidential address to the chemistry section, by Professor Bedson, of the Armstrong College, Newcastle, is the periodic law of Mendeleiff, and the position of chemists in relation to industries. The chemical work done during the war period will be covered by Sir William Pope ("Chemistry during the War"), General H. Hartley ("Chemical Warfare"), Lieut.-Colonel C. D. Crozier ("High Explosives"), and Professor Boswell ("Geochemistry during the War"). During the meeting the Holton Heath Cordite Factory will be inspected. The report of the Fuel Committee should be of immediate commercial interest, and the chemistry of coal-tar will be the subject of a paper by Dr. R. Lessing. It promises, altogether, to be an important and attractive meeting.

Industrial and Scientific Research

WE publish to-day an abstract of the report on the work done during the past year by the Department of Scientific and Industrial Research. The work of the Department, we are told, has steadily grown in usefulness and amount, and those who read through the report will readily agree that much has been done to awaken an interest in research, to link it up with industry, and to start investigations into several important problems. Useful work especially is being done in connection with fuel research, food investigation, tin and tungsten research, and other subjects, while other developments are in prospect. Taken in detail the work is excellent, but we are inclined to agree with the criticism that the influence of the Department would be greater if its basis were more representative, and if steps were taken to provide for a more comprehensive consideration of the requirements of science and industry as wholes.

German Dye and Chemical Industries

American Commission of Inquiry

IN the course of the next few months the American Chamber of Commerce in London should be in possession of some definite information as to conditions in Germany's dye and chemical industries. Two investigators, representing the Dye and Chemical Trade Groups of the Chamber, have left London for Paris, whence, equipped with the necessary documents from the authorities there, they will proceed into Germany and Austria, and possibly certain districts of Russia. Both men are American citizens, Mr. Irving A. Keene, of the Keene Co., manufacturing chemists, of London, who is chairman of the Chamber's Chemical Group, and Dr. Jules Bebie, representing the Monsanto Chemical Works, of St. Louis, Missouri. They will make a particular study of German methods of production and the possibilities of Germany's import and export trade in dyes and chemicals with the United States and Great Britain.

The question of future business will be studied also from the financial side. Precautionary measures against the dumping of German dyes or dye stuffs direct or through neutral intermediaries will be suggested if there seems to be need for further steps beyond those already taken by the American and British Governments to protect their native industries. According to the American Chamber of Commerce in London, these representatives expect to be away two months or more.

Mechanical Handling of Chemical Materials

By George Frederick Zimmer, A.M.Inst.C.E.

In the second instalment of his article Mr. Zimmer deals with the handling of powders and the practical difficulties which they involve. He describes how the pneumatic principle has been applied, and the success which has followed its introduction.

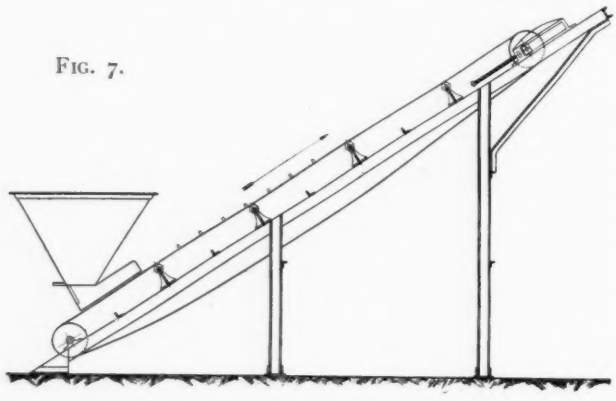
II.

IV.—*The Handling of Fine Dry Powders.*

POWDERS of a similar nature to flour, sugar, salt, and spice, are all more or less difficult to handle, and indeed only a limited number of conveyors can be used for this purpose, and then often only with indifferent success.

The reasons why fine material is so much more difficult to handle than coarse are various. One of the principal is

FIG. 7.



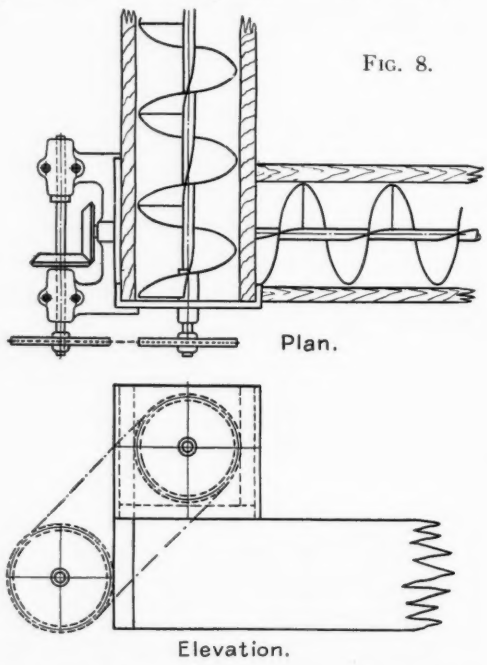
the production of dust at the very slightest agitation, so that a conveyor which moves the material by a stirring, pulling, or pushing device must either be eliminated altogether or be enclosed in order to prevent dust and loss. Even with conveyors which perform their functions without this agitation, and in which the material is carried as it is on a band conveyor, the usual high speed at which these conveyors work will create dust by the resistance of the air to the passage of the material.

There are also other difficulties caused by the great difference in the physical nature of various fine materials. Some are of a lively nature and run through one's fingers, and this class of stuff requires a close-fitting conveyor, say of the pushplate or worm type. With a belt conveyor there is a tendency for such stuff to run off unless the belt is well troughed or fitted with skirting boards. Other fine materials are of just the opposite consistency, almost "dead," as, for instance, fine cement, which, if conveyed in a pushplate conveyor, has a tendency to lie at the bottom of the trough and let the scrapers travel over the top. Then, again, there is a difficulty in handling fine material on account of the tendency of fine particles to enter the working parts of the conveyor. If the material is of a sharp and cutting or corrosive nature this is one of the principal drawbacks, as such parts are soon destroyed by wear and tear.

It will thus be seen that for the conveyance of fine materials by mechanical means the utility of several types of conveyors is somewhat restricted. Belt conveyors can be used if the material can be fed on and off without causing dust, also if the belt travels sufficiently slowly. All conveyors with agitators can only be used for certain kinds of material, and then only when running extremely slowly or when completely covered in. This is difficult, particularly with pushplate conveyors, the general construction of which does not permit of covering in without complications. The reciprocating conveyor of the Zimmer type appears, at first sight, very suitable for handling fine material, because the trough can easily be covered with a dust-tight lid, and there are no stirring or pushing elements to create dust, or which are subject to wear; but there is again an objection, namely, that with this type fine material can only be conveyed satisfactorily in a very thin layer, and then preferably on a slightly downward gradient, so that with this device the same objection holds good as with the belt conveyor. Both can be made to do the work, but the capacity is small on the belt conveyor on account of the slow speed, and on the Zimmer conveyor on account of the thin feed, so that both these types, if used for fine material, will have to be made relatively wide for capacities which could be conveyed on smaller conveyors if the material was coarse.

A method of conveying common salt is a band conveyor with wooden slats across; these slats help such a band to carry up at an incline of 40 deg. Fig. 7 shows such a conveyor or elevator, 20 ft. long from centre to centre, which handles a ton of salt per hour from the lower hopper, which is provided with a sieve, to the upper terminal. The band used is a 12 in. balata, the wooden battens are 12 in. pitch, and the speed of the band is 150 ft. per minute. Notwithstanding the satisfactory solution of some of the conveying appliances, for the majority of cases the worm conveyor is undoubtedly the best; it can be fitted with a dust-tight lid, and with as many intermediate inlets and outlets as may be necessary. It does the work well if the material is not of a cutting nature, it is inexpensive in first cost, but when

FIG. 8.



used for long distances and large capacities it loses somewhat in economy. The driving power is relatively high when compared with other conveyors, but this is of minor importance since there are but few appliances which are suitable for fine powder. A great advantage of this conveyor is the ease with which material can be conveyed round a corner (see Fig 8.) The worm conveyor is an

extremely simple mechanism, and with all its good and bad points is practically unsurpassed. Such devices can, moreover, be used at any incline, and a continuous spiral can even be used vertically when run about fifty per cent. faster than for ordinary horizontal conveyors.

Tubular Conveyors

For the most difficult materials, a modification of the worm conveyor, the internal worm or tubular conveyor, is a first-class device. It is but little known, and consists of a cylindrical or rectangular tube, the inner periphery of which is fitted with a helix in the former and with a series of oblique blades in the latter case. These tubes are caused to revolve bodily round their imaginary axis, whereby the material fed in at one end is forced to tumble down always to the lowest point; the helix or blades cause the material to fall in a forward direction. Since this method of conveying is due to gravity, the number of revolutions of the tube must not exceed fifty to sixty per minute, as at a higher speed, centrifugal force will come into action and prevent the material from sliding down. The only drawback of this type of conveyor is that it cannot readily be made longer than fifteen or twenty feet without some complication, since these conveyors can only be supported from the outside by rollers (see Fig. 9).

For elevating fine powders the ordinary bucket elevator will answer. Such elevators are generally totally enclosed in a dust-tight wooden casing. The buckets are attached to webbing or so'id woven cotton bands. If the powder clings together like flour the buckets must be shallow, and

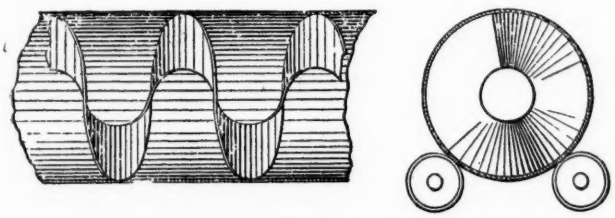


FIG. 9.

if it is lively, deep. Feeding devices are only necessary or advisable in the former case.

There are a few points of importance concerning such elevators. Great care must be taken to feed at the upgoing side, and the delivery shoot from the upper terminal must be placed sufficiently low so that all the material is caught by the spout. If this is too high up, some of the powder drops past the sheet-metal tongue, shown on the illustration (Fig. 3 in issue of August 30), and falls down the leg, and as this leakage is continuous, a draught is created by the falling material in the elevator going round with the buckets, and in consequence of this, dust will blow out of every crevice. If the material is "dead" it takes longer to free itself from the buckets as they negotiate the upper terminal, and the spout, in order to catch all, should be lower by rights than when dealing with lively powder. But the best practice is to place the bottom of the delivery spout below the level of the lower face of the internal elevator pulley in all cases, then one is sure that no spilling can occur. Should the powder be of an extra clinging nature, a slow-running inclined elevator, or one of the vertical dumping type, is necessary. This latter type of elevator must be fitted with two endless chains and no textile belt, and if chains are objectionable the elevator must run slowly as mentioned, and be much inclined, say 45 deg., to the horizontal. As a final hint there should be hand holes through which the boot of the elevator can be relieved, and through which the delivery at the top can be observed. There should also be a hand hole on every floor of the factory through which the elevator passes, and one sufficiently large—say, 2 ft. to 3 ft. long—through which the band can be tightened when it has become too slack—that is to say, after all the "take-up" of the tightening gear has been used up.

Dealing with Powders by Pneumatic Means

One of the best methods to handle the most troublesome powders, both horizontally and vertically, is the pneumatic system. At the writer's suggestion such devices were installed in some of the explosive factories to deal with the finest powdered aluminium, which could only be handled manually with the greatest difficulty and loss. The pneumatic installations were perfectly successful, both from the economic point of view and from the fact that they eliminated one of the most objectionable and dangerous operations. Apart from conveying such fine powders, they may be withdrawn from the grinding machine which produces them, instead of separating them by screens.* This is performed by a current of air, so regu'ated in strength that only the finest possible dust is picked up, and blown into a receiver to settle, from whence it is removed at intervals. The pneumatic apparatus successfully employed for this work includes a vacuum pump, which, at a normal speed of 160 revs. per minute, has a displacement of 20,000 cubic feet per hour, and will produce a vacuum of 18 in. of mercury. The dust and air are separated in a cyclone dust-collector, following which there is a second dust-collector, and finally the air is drawn through a shallow water lock or sump, and thus returned clean to the vacuum pump. The pipe connections are the ordinary gas pipe, but with bends of larger radius. Inclined pipes are preferred to vertical ones, and flexible hose fitted with suction nozzles is used to pick up the material. Such a plant will deal with 1½ to 2 tons per hour of such material as arsenic oxide. The furthest branch of the pipe system is 200 yards from the apparatus, and the driving power necessary will be from 12 to 14 h.p. Such plant is built by the British Vacuum Cleaner Co., Ltd., of London.

V.—*The Handling of Fine Moist Material.*

There is some slight affinity here with Section III—*i.e.*, the moisture may be more superficial or the material may resemble moist sugar in nature. In both cases steel-band conveyors are suitable, although a compound textile rubber band may be best if the moisture is likely to be injurious to the band—ordinary moisture (water) will not rust steel bands owing to their highly compressed nature. These conveyors may run fast in both cases—say, 6 ft. to 8 ft. per second—the steel band is provided with scrapers, and the compound textile rubber band with a revolving brush driven from the delivery terminal. In both cases an occasional washing of the band is necessary. The tray, pan, or continuous trough conveyor will also do well for many such substances. The reciprocating conveyor will answer almost equally well, but it must be on a downward gradient of not less than 4 to 5 per cent. Occasional washing would also be necessary here.

Salt Conveyors

There is a type of conveyor in use with a stationary trough, made with a plate-glass base, in which hinged blades move backward and forward, agitated by a reciprocating rod. The blades are nearly vertical during the forward stroke, and they slide over the material when returning idle. These devices are used in salt works, and handle the salt immediately it is raked from the mother liquid.

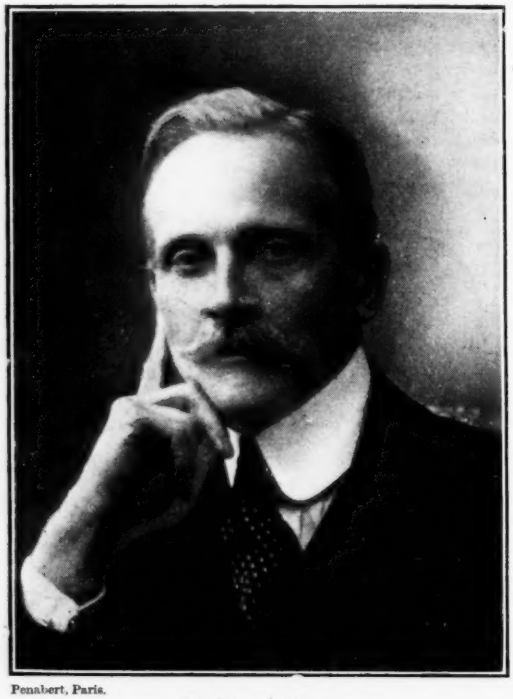
When the material has to be lifted vertically as well as horizontally it is better to employ a band conveyor of either type for the dual purpose. Bucket elevators will do if provided with very shallow buckets and if the substance is not sticky, or but slightly so, in order that it may not hang up in them when they are inverted at the delivery end. They should be slow-speed bucket elevators, either at an incline or of the vertical dump type.

* See Paper by T. C. Cloud, "Transport of Material in the Form of Dust," before the Society of Chemical Industry, January 15, 1916.

An Interview with M. Paul Kestner

A French Tribute to English Chemical Pioneers

In the world of chemical industry it would be difficult to find a better known name than that of M. Paul Kestner, President of the *Société de Chimie Industrielle* of France, which has objects similar to those of the Society of Chemical Industry of Great Britain. Until after the outbreak of war there was no such society in France, but during the progress of hostilities the need of organisation was keenly felt, and so the Society was rapidly and successfully brought into existence under the guidance of M. Kestner, as the founder. Although only two years old, the *Société de Chimie Industrielle* has already a membership roll of over three thousand names, the bulk being French, but some being English. The official journal of the *Société* is *Chimie et Industrie*, and it has grown to be an important and influential organ. M. Kestner is also a member of the Society of Chemical Industry, with which he has been associated for many years; his official visit to London in November, 1918, and the proceedings in his honour, will be vividly recalled by all who were present on the occasion as one of the most remarkable in the annals of the Society. One of the features of his visit at that time was an address by him to the London Section on "The Alsace Potash Deposits and their Economic Significance in relation to the Terms of Peace."



Penabert, Paris.

M. Paul Kestner.

A Successful Inventor.

M. Kestner first made his name in the chemical world as the inventor of automatic elevators for use in acid works, which together with his system of draughting towers, are now found in acid works the world over. These inventions were quickly followed by others in connection with evaporators, and the Kestner "Climbing Film" is now accepted by the scientific world, although in the early days it caused a great stir among men of science, particularly in Germany. M. Kestner has used his inventive genius in many varying directions, and few men have lived to see their inventions come into such world-wide use. M. Kestner is the chairman of the Kestner Evaporator and Engineering Co., Ltd., a company well known to our readers. He is also consulting advisor to the American Kestner Evaporator Company.

At the present time M. Kestner's home is in Paris, but he used to reside at Lille, from which he was driven by the German invasion, one result of which was the destruction of his properties—his works at Lille, and his family properties in Alsace, where he was born. The Germans not only removed all the valuables from the old chateau, which they partly destroyed, but turned the private grounds immediately surrounding it into one vast graveyard.

As a chemical engineer, M. Kestner is, it is scarcely necessary to add, quite at home in England, and has many friends here, not the least of whom is Professor Henry Louis. The latter, speaking at a luncheon in London in honour of M. Kestner, and referring to the French Society, paid a well-deserved tribute to their guest's energy and ability, and to those associated with him, in "being able to found a Society of Chemical Industry in France at a time when their country was in the throes of a conflict, straining every fibre of the nation's strength, and when, moreover, their chief industrial centres were held in the grip of the enemy. In spite of such difficulties the Society was formed, and its success was instantaneous, owing in great measure to the liberal financial support accorded to it by French manufacturers, who were prompt to appreciate the value to them of a strong technical society. It was worth recording that the *Société de Chimie Industrielle* had, in the eighteen months since its foundation, received financial support many times as great as had been given to the British Society of Chemical Industry in all the thirty-seven years of its existence."

Chemical Reconstruction in France.

Speaking to a special correspondent of The Chemical Age the other day, M. Kestner was quite obviously full of anxiety for the reconstruction of French chemical and technological interests. "I am anxious," he said, "to do all I can in this direction, but latterly my work for France has been in quite a different category—one occasioned by the awful chaos produced by the war. I have been busy organising propaganda to fight against the Germans on Peace being proclaimed. The work, as you will no doubt understand, has included active propaganda against Bolshevism; for no truly patriotic citizen of France could for the moment bend his energies in any other direction."

"I am pleased to think," remarked M. Kestner, "that I was present at the meeting last year of the Society of Chemical Industry, for it was on that occasion that the first discussion took place which led to the idea of the International Conference, which is to bring closer co-operation between the chemical associations of the allied countries. Judging from the progress that has already been made in the matter it is almost certain that good results will accrue. Whenever I look back and recall our gatherings at Liverpool, Manchester, Birmingham, Leeds and London, I think of the Society of Chemical Industry as a large family circle, and I feel proud of being one of the members of that circle.

English and French Relations.

"In promoting the *Société de Chimie Industrielle* I endeavoured to follow the splendid example set by the Society of Chemical Industry. Our object now is to establish for the future a close collaboration between our two societies, to forge bonds of fellowship, and to draw up a common programme for pacific warfare. The great pioneers of the chemical industry—and I refer especially to the alkali in-

dustry, in which I started my career—have traced for us a programme. They have led the way in associating our two countries in all the great discoveries which laid the foundations of this industry. On the one side we have Muspratt, Chance, Weldon, Deacon, Brunner, Mond, and many others; on the other side, Le Blanc, Gay Lussac, Kuhlmann, Pechiney, and (to add a Belgian) Solvay. The Society of Chemical Industry was founded by the inheritors of the traditions of the great pioneers of the English alkali industry, and it is very largely due to this fact that England has no cause to be jealous of Germany."

M. Kestner contended that German chemical supremacy has never existed except in the domain of organic chemistry. In mineral chemistry, in electro-chemistry, and in biological chemistry, he claims that the allied countries have been outstripped by none. He begs of the two countries to keep in touch and unite their efforts, and to help one another so as to wage in the sphere of economics a war which must last until Germany has paid the full penalty. He thinks that of all the industries, the chemical industry is perhaps that where the contest will be fiercest. M. Kestner is certain that the Inter-Allied Federation will always keep in view the turning of the forces of nature to the service of man, and work in the spirit of the phrase, "Each for all and all for each."

Naturally M. Kestner feels very acutely the devastation caused by the Germans in the chemical towns of France, but hopes that, backed by the Allied countries, and particularly by Great Britain, the time is not far distant when they will appreciably recover much of their erstwhile activity.

Ammonia Soda Company

Resolution for Voluntary Liquidation

THE annual meeting of the Ammonia Soda Co. was held at Lostock, near Northwich, last week, Mr. John H. Willcox presiding. A dividend of 6 per cent. was sanctioned on the preference shares, carrying forward £15,000. A resolution was then proposed that the company go into voluntary liquidation.

Mr. Henry Ellison, of Bradford, proposed that an independent expert be appointed to examine the company's plant, and report to the shareholders, Mr. Stanley Smith, of Chancery Lane, London, being suggested as the expert. This was lost.

The Chairman admitted that Brunner, Mond, & Co. held by far the major part of the capital, that Brunner's had requested them to go into liquidation, that prior to the present notice no other shareholders had been consulted, that the directors are all former or present officials of Brunner, Mond & Co., and that the Brine Wells had been dismantled with the view of preventing possible contamination of the brine supply of the two concerns by calcium chloride liquor. The Chairman said this had been done upon the advice of Mr. Stanley Smith, who made the proviso that Brunner, Mond & Co. should supply the Ammonia Soda Co. with an unlimited supply of brine from other sources. Hereupon, Mr. Smith asked whether this proviso would stand good in the event of any other concern than Brunner, Mond & Co. taking over the Ammonia Co. The Chairman could not answer for that, but upon being asked whether the directors of the Ammonia Soda Co. had been advised by former or present officials that with certain alterations and extensions of plant the business of that company might be made highly profitable, he replied that originally the directors had been so advised, but subsequently they took what they considered better advice.

Answering the question whether before deciding upon liquidation the directors would consult the minority shareholders and reconsider the position, the chairman replied that the shareholders were being consulted by the present proposal to liquidate the concern.

Asked whether the business of the company (the manufacturing of soda ash) was not a highly profitable business, and whether there was any reason why by good management the business of the Ammonia Soda Co. could not be made highly profitable, the chairman replied that in the opinion of the directors it was not highly profitable. A question whether Brunner, Mond & Co. did not stand to benefit substantially by the liquidation of the Ammonia Co. was ruled out of order.

Some Chemically Reactive Alloys

AT the last meeting of the Faraday Society Mr. E. A. Ashcroft read a paper "On Some Chemically Reactive Alloys," accompanied by experiments. He stated that an alloy of 15 per cent. of pure magnesium with 85 per cent. of pure lead has the remarkable property that upon exposure to moist air oxidisation of both the magnesium and the lead proceeds so rapidly that a lump of alloy so exposed swells up and falls to a black powder in a single night, or in some instances even in an hour or two. The reactions to this point may be expressed thus:—

(*a*) $Mg+O+H_2O=MgO_2H_2$,
(*b*) $2Pb+O+H_2O=Pb_2O_2H_2$,

from which it will be seen that both water vapour and oxygen take part, and that hydrate of magnesium and sub-hydrate of lead are the products formed. On more prolonged exposure the finely divided sub-hydrate of lead will pass over completely into the hydrate PbO_2H_2, with a corresponding change of colour. However, a much longer period at ordinary atmospheric temperature is required for this second stage of oxidisation.

Oxidisation of the sub-hydrate of lead to the hydrate can be accelerated by the addition of water to the powder, the oxidisation then going on quite rapidly, and as this oxidisation is accompanied by an evolution of hydrogen it would appear that it is entirely due to water vapour. Shaking up the oxidised alloy in water in which carbon dioxide has been dissolved produces a very nice quality of white lead, and this application of the alloy may prove industrially useful.

The author proceeded to demonstrate the entirely different behaviour of the alloy at atmospheric temperature in the presence of ordinary moist air and in the presence of reasonably dry air. In the latter case the reaction does not take place. In this experiment is indicated a ready means of producing nitrogen or nitrogen and hydrogen mixtures from these alloys, or of removing remainders of oxygen from various mixtures in the cold. Such a method may find many industrial uses.

Another application of the alloys might possibly be the production of hydrogen alone, which takes place readily and quantitatively by boiling the powdered alloy in water. This method of producing gases, although it cannot hope to compete with the larger established methods economically in the best situations, still has a great advantage in that the gases can be produced very readily where wanted, and for transport purposes to a great distance (as compared with cylinders) there is very great saving of weight shown. For the production of hydrogen a 30 per cent. Mg alloy is best, whereas for the atmospheric oxidisation previously described the maximum effect is obtained with about 15 per cent. alloy, and with about 30 per cent. on the one hand and 10 per cent. on the other the effect becomes much slower or ceases altogether.

Still another alloy of some interest is the eutectic $MgZn_2$. This alloy possesses very different properties, inasmuch as it can be pounded fine, passed through a 100-mesh sieve, and exposed to the air almost indefinitely without oxidation. It is likely to find industrial application in connection with the removal of gold from cyanide solutions, as well as for pyrotechnic purposes.

A few words were added regarding the manufacture of these alloys, and it was shown that the cost of the alloys became largely a question of the cost of anhydrous magnesium chloride. From the figures given it was shown that under favourable conditions in regard to cost of energy there is no reason why magnesium lead alloys or magnesium zinc should not be produced at prices not greatly in excess of the cost of the basic metals lead and zinc. Such results, however, were dependent for their realisation upon the opening of sufficiently large markets to make it worth while to carry out the operations on a fairly large scale.

Dr. J. A. Harker, F.R.S., suggested using the method for removing oxygen contaminating the hydrogen used for balloons.

Dr. E. Rideal thought the action a catalytic one based on electrolytic processes, similar to the behaviour of iron in removing small traces of chlorine from water.

Dr. H. C. Greenwood said the method might be useful in preparing argon from commercial oxygen.

SIR BENJAMIN JOHNSON has resigned his position as Director-General of Factories, and Mr. E. C. Given has been appointed by the Ministry of Munitions to succeed him. Sir Benjamin Johnson is managing director of Messrs. Johnson Brothers (Dyers), Ltd., and an ex-mayor of Bootle.

Methods of Lifting Sulphuric Acid

By Sidney J. Tungay

Just prior to the war a good deal of attention was given to methods of raising acid by means of pumps in lieu of the old-established practice of using compressed air for the purpose. Early experience with the single-stage centrifugal pump was certainly not encouraging, but in the following article the writer traces the progress which has been made, and describes the multi-stage pumps which appear to have solved the problem.

In reviewing the various articles and books printed on the subject of the manufacture of sulphuric acid, and dealing with the chamber process, it would appear that comparatively little attention has in the past been given to the question of methods of raising sulphuric acid for supplying Glover towers and Gay Lussac towers. Yet in connection with an installation for manufacture of sulphuric acid, either by the chamber process or by the more modern system of towers, the greater part of the power required for working the installation is consumed for the sole purpose of lifting the acid to the top of towers in the course of its manufacture. Compared with the power required for this purpose, the actual power consumption in a vitriol works for working mechanical roasting furnaces and for driving blowing, or exhausting fans, or for concentration purposes where concentration is effected, is, in comparison, almost a negligible item. It should be understood, in the first place, that the question of "efficiency" in connection with machines and plant consuming power is quite a different matter from the acid manufacturer's point of view from the actual "work effected"—that is to say, it is not the amount of "power consumed," but the actual "work done" which is in reality the most important factor.

Judging from most authorities on the subject of vitriol manufacture, it is commonly understood that the use of compressed air for lifting purposes has been found to be more or less unsatisfactory, and far from economical. By giving some thought to this question of compressed air, it is obvious that, as the compressed air loses its power upon expansion, this spending of the air itself represents constant and almost total loss. If it were by any means possible to use the compressed air over and over again, by conducting it back to the suction side of the compressors instead of being compelled to let it free into the atmosphere, this obvious loss could to some extent be avoided, but in view of the fact that the compressed air used always contains an amount of acid and acid vapours, it is in actual practice impossible to use the air over again.

Compressed Air Losses

A patent was taken out in 1885 by Johnson and Hutchinson (British Patent 8,141) which described a combination of three upright vessels, connected in such a manner that the compressed air contained in one is always utilised in the next, and is not lost, as in the usual manner. The writer knows of no installation that has so far been arranged on this system of series treatment. In addition to the loss of the compressed air itself, engineers have no need to be reminded that a further considerable loss is occasioned in course of transmission, as well as through pipe friction, leakage, friction of compressors, and motors, altogether amounting to a considerable item.

For a very long time past trials have been made on the Continent, in America, and to some extent in Great Britain, with various forms of plunger pumps, for the purpose of lifting sulphuric acid and avoiding the use of compressed air and acid eggs, but until recently these pumps have been found practically useless for lifting acid to any considerable height. The further considerable increase, in connection with modern sulphuric acid plant, in the height of the chambers and also of the Gay-Lussac towers and Glover towers, and the further replacement of the chamber system by the various types of tower plant for vitriol manufacture, which have been introduced of late years, have compelled manufacturers to consider the best ways and means for lifting vitriol to still greater heights than 50 ft. to 60 ft. formerly required, for which height compressed air and acid eggs were so frequently adopted. One authority has stated that of the entire amount of power utilised for working a sulphuric acid plant upwards of 71 per cent. is consumed in the lifting of the acid, and that the cost has been found to work out altogether at 0.8 pence for each 100 kilos of 50° Be. acid lifted, and that nearly 3 per cent. of the total cost of manufacture in some works is expended on the actual lifting of the acid.

In view of this fact it must be admitted that any solution of the problem of more cheaply pumping or lifting sulphuric acid is a matter of very considerable value, and by no means negligible to the vitriol manufacturer. A pump was designed some time ago by Moritz (French Patent 441,304). In this design, the inventor placed the pump proper, which was constructed of some acid-resisting metal or material, actually within the acid contained in the tank, and claimed that by such means many of the difficulties incidental to the pumping of acid would be avoided. The system, however, has not been adopted to any large extent, and there are obviously counter objections to submerging a pump in a tank of acid.

Another type of pump which has been used more recently is that designed by Ferraris (British patent 4,482 of 1914). In this design Ferraris interposes a layer of some suitable oil, or even proposes the employment of a layer of mercury between the pump cylinder and pump piston and the acid to be lifted, with a view to preventing any corrosion of the pump cylinder and piston. This really amounts to a displacement chamber attached to each pump, wherein the heavy oil is displaced by each stroke of the piston drawing up an equal volume of sulphuric acid at each stroke, this acid being discharged at each return stroke of the piston. In some cases these pumps have been said to give good service.

Disadvantages of Pumps

The chief difficulties and objections have been trouble experienced with the valves and the high cost of a suitable oil to be used in the displacement chambers. The extremely slow speed at which such pumps must necessarily work has also been found a drawback, also the high cost of installation of these rather large and somewhat complicated machines. In fact, all acid pumps which possess valves, or any system of valves, are liable to give trouble from time to time, hence a centrifugal pump or some other form of valveless pump would seem to be the best solution of the difficulty.

For a long time past in Continental works various forms of centrifugal pumps have been adopted for raising acid to Glover towers and Gay-Lussac towers, and it is with a view to pointing out the improvements in this direction that the writer was prompted to write this article. It is within the knowledge of most chemical engineers that in the past great difficulties have been experienced with the working of centrifugal pumps for sulphuric acid. In many cases it has been thought that pumps could not be suitably or satisfactorily adopted unless electric power at a cheap rate was available at the works, and it so happens that many sulphuric acid

installations are far removed from any cheap source of electrical energy, and in many cases have no electrical installation of their own. This, in the past, has been a factor against the introduction of pumps, even if pumps had been found of a suitable type and design, and sufficiently economical in working.

For a long time the writer experimented in different acid works with various modifications of simple single-stage centrifugal pumps, and carefully noted the failures of these pumps, their different behaviour under varying densities of acid, and the various troubles occasioned by acid at high temperatures. Among other difficulties the extremely corrosive nature of warm nitro-sulphonic acid upon most metal surfaces has always presented one obstacle. The possibility of leakage of acid from imperfectly packed glands and the suitability or otherwise of packing material for retaining such acid under pressure was another. Again, the natural conservatism of acid manufacturers to adopt a new system for the lifting of large quantities of acid proved a further hindrance to the adoption of pumps, as against the older and more complex installation of air compressors, in conjunction with acid eggs, with their need for continued supervision.

The first objection has been overcome during the last few years by the placing upon the market of modern acid-resisting metals and forms of passive iron which are proved capable of withstanding all corrosion from either nitric or sulphuric acid. The second objection called for the efforts of chemical engineers to design pumps in such a way that no risk of any serious leakage at the glands was incurred.

Acid-resisting Pumps

Pumps as shown in Fig. 1, constructed with a single impeller having side suction, the impeller being balanced, and carried through a packing gland on either side, worked very well for lifting chamber acid or Glover tower acid to a height not exceeding 35 ft. to 40 ft. At the latter head they began to give trouble, as, if worked continuously, the strain was found to be excessive for a pump of this type. With these single-stage pumps one of the great difficulties to be overcome was the continuous leakage at the glands, due to the fact that this type of pump has two glands, one on either side of the rotor, both being subject to the constant pressure of the acid which is being lifted. The stuffing boxes on either side of the pump chamber were then improved by the insertion of annular rings below the packing material, these being furnished with small pipes and taps (shown in the illustration) in such a way that a connection could be made with the suction pipe, and the glands were then worked under suction instead of being called upon to sustain a pressure. This, although a decided improvement and preventing the leakage at glands, did not improve the efficiency of the pump.

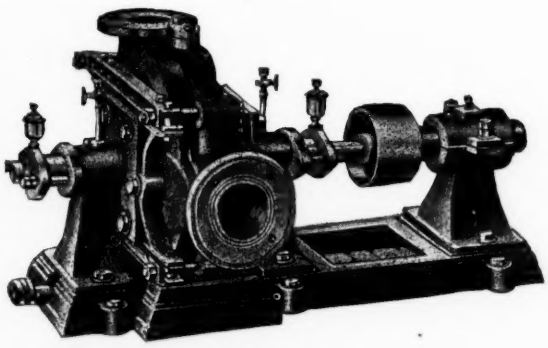


FIG. 1.

The following is a series of tests, taken from a pump as shown in Fig. 1, working with sulphuric acid of 106 to 108 Tw. at 70° F. :—

Pipe connections			1″	1¼″	1½″	2″
Average Capacity per Minute Galls.			15.5	20	31	55
10′	Height of Lift	R.P.M.	1450	1220	1150	1050
		H.P.	.3	.3	.45	.6
16′ 6″	,, ,,	R.P.M.	1700	1450	1360	1200
		H.P.	.375	.45	.645	.75
23′	,, ,,	R.P.M.	2000	1620	1510	1370
		H.P.	.525	.6	.9	1.35
30′	,, ,,	R.P.M.	2270	1840	1720	1560
		H.P.	.675	.825	1.2	1.65
36′	,, ,,	R.P.M.	2500	2020	1890	1720
		H.P.	.825	.975	1.5	1.95
43′	,, ,,	R.P.M.	2700	2170	2030	1850
		H.P.	.975	1.2	1.08	2.4
50′	,, ,,	R.P.M.	2850	2320	2180	1980
		H.P.	1.125	1.35	1.95	2.85

The power consumption increased proportionately in ratio to the increased density of acid, and the figures given apply to tests carried out when the acid flowed into the pump under a head of 1 ft. to 2 ft.

Further trials with pumps of this type arranging a suction head proved that cold acid of density named could be lifted from a depth of 8.5 ft., but the pumps failed to lift satisfactorily from any increase of this suction head. In cases where the acid was hot, no suction lift could be satisfactorily maintained, and it was found necessary to arrange for the acid to flow into the pump.

Multi-stage Pumps

In consequence of these shortcomings, and the fact that single-stage pumps, even of the best design, made for lifting acid were not found to be suitable for continuously lifting chamber acid or Glover tower acid for a greater height than 35 ft. to 40 ft. at the outside, further experiments were made with turbine pumps, or multi-stage pumps, of the design shown below (Fig. 2).

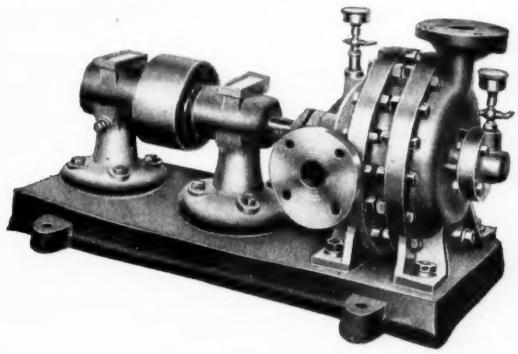


FIG. 2.

In carefully examining this illustration it will be observed that the pump shown is built up from separate sections form-

ing a complete centrifugal pump of three stages, having three impellers and three separate chambers. The results obtained by this pump are very greatly in advance of anything hitherto resulting from a single-stage pump; with a pump built up of three stages in this way a total head of 150 ft. lift has been obtained under test. In designing a multi-stage or turbine pump for these higher lifts, it was found that the increased manometric pressure of the acid, when lifted to a great head, would still be a difficulty to be overcome. Therefore the pump had to be entirely re-designed, with the outcome that there are now no glands under pressure.

On the pressure side there are no glands whatever, but simply a thrust bearing, which is totally enclosed, and lubricated by means of a grease cup. The only gland is on the suction side, and immediately the pump is set to work, this gland is relieved of all pressure, and has only to be kept sufficiently tight to avoid any inlet of air from the atmosphere, for, if anything, the gland is subject to a slight suction at this point. By multiplying the stages of these pumps, very considerable lifts can be obtained, varying, of course, according to the speed at which the pump is working. To run these pumps still more durably, ring-oiling bearings are fitted, so that the shaft, when running at high speed, is freely and continuously supplied with oil.

At the extreme outer end of the shaft a ball-thrust bearing is fitted, which takes all the thrust due to the weight of the head of acid. This is a most important point in pump construction, and many of the earlier designers found that when attempting to lift acids to any considerable height the bearings of the pump became greatly overheated and ultimately held the pump up, owing to the fact that a considerable thrust pressure was exerted in the attempt to carry the acid to an increasing head. By the arrangement of substantial fixed-bearing brackets on either side of the driving pulley there is no difficulty in driving these pumps by belting from a motor or from counter-shaft, and for chemical works practice, this method is to be preferred to direct-driven pumps coupled to motors, the pumps in many cases being fixed in such a position and so near to the acid plant that it is better to keep the motors at some distance from the acid and acid fumes, or drive from a counter-shaft.

In view of the fact that pumps supplying Glover towers and Gay-Lussac towers must of necessity be almost continuously at work, it would not be reasonable to expect a continuous lift up to 150 ft. head from such a pump, but for working Glover towers, where the acid has to be lifted to a total height of, say, 75 ft. to the supply tanks, a three-stage pump of this description possesses an ample margin over the work demanded of it, and should last for years if properly and carefully fitted up, and so arranged as to be practically free from vibration. It may be added that all centrifugal pumps must run freely and steadily, and there should be, as far as possible, a complete absence of vibration if satisfactory working and reasonable freedom from wear and tear are to be obtained.

Below are given some results of tests obtained from the working of these multi-stage or turbine pumps, fitted with two, three, and four stages, from which it will be seen that the work effected shows a very great improvement over compressed air, even as far as mechanical efficiency alone is concerned. There are, however, other factors to be borne in mind in chemical works practice in connection with the lifting of acids, which, although perhaps not so important as actual mechanical efficiency or the amount of work done, are yet very necessary considerations from a works manager's point of view :—

Pipe connections	1½			2			3			4		
Average capacity, gallons per minute	27			44			155			220		
Number of Stages	2	3	4	2	3	4	2	3	4	2	3	4
R.P.M. appr.	1380			1280			980			870		
Head in Feet	22	32	42	22	32	42	22	32	42	22	32	42
H.P.	.68	1.02	1.36	1	1.5	2	2.6	3.9	5.2	3.8	5.7	7.6
R.P.M. appr.	1800			1700			1300			1150		
Head in Feet	40	60	80	40	60	80	40	60	80	40	60	80
H.P.	1.1	1.65	2.20	1.70	2.55	3.40	4.8	7.2	9.6	6.6	9.9	13.2
R.P.M. appr.	2160			2040			1560			1380		
Head in Feet	56	84	112	56	84	112	56	84	112	56	84	112
H.P.	1.44	2.16	2.88	2.30	3.45	4.60	6.4	9.6	12.8	9	13.5	18
R.P.M. appr.	2460			2320			1770			1580		
Head in Feet	74	110	146	74	110	146	74	110	146	74	110	146
H.P.	1.90	2.85	3.70	3.1	4.6	6.2	8.8	13.2	17.6	12	18	24

Nitrogen Products and Carbide Co.

To the Editor of THE CHEMICAL AGE.

SIR,—In the course of the past few weeks frequent reference has been made in the public press to the Nitrogen Products Committee and the activities of that body in connection with the fixation of atmospheric nitrogen. It appears from inquiries which have been addressed to us that the close resemblance of the name to that of this company has been responsible for a certain amount of misunderstanding. We shall, therefore, esteem it a favour if you will be good enough to permit us, through your columns, to offer a few words in explanation.

The Nitrogen Products Committee is a British Government organisation, which was brought into being while Mr. Lloyd George was Minister of Munitions. It is composed of scientific experts, and includes among its members many eminent men. Its object was to investigate and report on various matters primarily relating to the fixation and utilisation of atmospheric nitrogen, with a view to facilitating the manufacture of nitric acid and its derivatives for munition purposes. The Nitrogen Products and Carbide Co., Ltd., on the other hand, is the owner of extensive works and water powers utilised for the manufacture of calcium carbide, calcium cynamide (the well-known fertiliser nitrolim), nitric acid and its derivatives. This Company was the pioneer in developing on a large commercial scale the process of fixation of atmospheric nitrogen by the cynamide method, and the oxidation of ammonia to nitric acid, for the use of which the French Government were granted a licence and erected very extensive works in the early period of the war. Trusting the above explanation may serve to remove an erroneous impression, yours, &c.,

A. W. OSBORNE, *Assistant Secretary.*

Nitrogen Products & Carbide Co., Ltd.,
Winchester House, Old Broad Street, E.C. 2,
August 28.

Sulphate of Ammonia

Withdrawal of Subsidy

THE Board of Agriculture and Fisheries have come to an agreement with the makers of sulphate of ammonia with regard to the maximum prices to be charged for this fertilizer for home agricultural use, for delivery in the eight months—October, 1919-May, 1920. These prices are appreciably higher than those ruling during last season, owing to the fact that the Government subsidy given to makers during the war has now been withdrawn. The agreed maximum prices are fixed on a commercial basis which has to cover the substantial increases which have occurred since last year in the cost of coal, wages, and raw materials. The Board consider that these prices are not more than are necessary to secure to the manufacturers a reasonable trade profit.

The agreed maximum prices for sale in lots of not less than two tons for delivery by rail or water to purchaser's nearest railway station or wharf in Great Britain, less a trade discount to agricultural merchants, dealers, and co-operative societies, are as follows :—

Month of Delivery	Price per Ton in bags, net cash £ s. d.
October, 1919	20 10 0
November	20 15 0
December	21 0 0
January, 1920	21 7 6
February	21 15 0
March, April, and May	22 0 0

In the case of deliveries to Ireland, Isle of Man, or Channel Islands, the above prices include delivery f.o.b. port in Great Britain. Farmers should place their orders without delay with their usual dealer or co-operative society. Manure mixers, merchants, dealers, and co-operative societies should send their orders to the Sulphate of Ammonia Association, 84, Horseferry Road, S.W. 1.

Supplies of Chilean Nitrate

Persistent rumours have been current for some time past of large transactions having been in treaty, and of some actually effected, through the Chilean Government, says the Valparaiso correspondent of the London and River Plate Bank in that institution's *Monthly Review* for August. The most recent of these rumours quoted that 1,000,000 tons a year for the space of five years had actually been closed through the Chilean Government's representative in Belgium with a private firm which undertook to supply the necessary tonnage to carry the nitrate. This report and the others were mere rumours with a speculative object and now appear to have no foundation. The effect has been to maintain nitrate shares at a high level, and the Government have ordered an investigation with a view to ascertain the origin of the reports.

On May 31 the stock of nitrate of soda on the coast, including that on the German ships, amounts to 30,515,963 quintals. The production during the month was 3,092,400 quintals, with 64 oficinas working, as against 5,295,200 quintals during May of last year with 117 oficinas working. The exports in May were 403,700 quintals, which is a decrease of 5,982,000 quintals as compared with the same month of last year.

The production and exports during the first five months of the last six years compare as follows :—

	Production Quintals.	Exports. Quintals.
1914	26,377,000	22,091,000
1915	10,075,000	14,200,200
1916	27,082,400	25,150,800
1917	26,780,600	23,374,700
1918	26,389,700	24,175,000
1919	17,034,400	4,435,100

The Association of Nitrate Producers has not altered the price of nitrate, which remains at 10s. 1d. for 95 per cent.

THE AMALGAMATION IS ANNOUNCED of Messrs. A. & J. Main & Co., Ltd., of Glasgow, with the engine works depot of Sir W. G. Armstrong, Whitworth & Co., Ltd. A new company, under the title of Armstrong & Main, Ltd., has been formed, with Mr. John Noble as chairman and Mr. J. A. Main, as managing director.

Chemistry Professors for Glasgow

IMPORTANT appointments to the Chemistry Department of Glasgow Technical College were made at a special meeting of the governors last week. At a joint meeting of the Chairman's Committee and the Committee on Chemistry and Metallurgy, held previously, a letter was received from Professor Henderson resigning his position as Professor of Chemistry on his appointment to the Regius Chair of Chemistry in Glasgow University. The resignation was received with regret, and acknowledgment was made of the great services Professor Henderson had rendered to the College. It was resolved to recommend that Dr. Thomas Gray, the Professor of Technical Chemistry, be appointed Director of the School of Chemistry, and that the vacancy due to Dr. Henderson's resignation be filled by the appointment of assistants in the department of chemistry—Mr. Forsyth J. Wilson, D.Sc., Ph.D., F.I.C., late Captain and chemical adviser to the 11th Army Corps), and Mr. Isodor M. Heilbron, D.S.O., D.Sc., Ph.D., F.I.C. (late Lieutenant-Colonel and a senior Staff officer in the Salonica Forces)—the former with the title of Professor of Inorganic and Analytical Chemistry and the latter with the title of Professor of Organic Chemistry.

The Chairman, in supporting the adoption of the minute, said it was very satisfactory that they had among their own staff two men capable of filling these chairs and of sustaining the high reputation the College had always had in chemistry. The minute was approved.

Following a distinguished career at Edinburgh University, Dr. Wilson did extensive research work at Leipzic and qualified for the degree of Ph.D. He is the author or joint author of several papers embodying the results of original research. Dr. Wilson became associated with the College at the end of 1905.

Dr. Heilbron, who belongs to Glasgow, has been a student of great distinction at the Technical College. He was awarded the James Young Exhibition, and proceeded to Leipzic. As a result of his work at the University there his Exhibition was continued and he took the degree of Ph.D. He was appointed to the Technical College staff in 1908, and is the author of several technical papers. The new professors were both on military service. Dr. Heilbron was three times mentioned in despatches. He received the D.S.O. in June, 1918, the Greek Order of the Redeemer in August, 1918, and the French Medal of Honour in July, 1919.

The appointment of Mr. William Kerr as research assistant in the department of mechanical engineering was confirmed, the Chairman stating that he hoped this was only the beginning of their research development.

Sir R. Glazebrook's Successor

THE Lord President of the Council has appointed Professor Joseph Ernest Petavel, D.Sc., F.R.S., M.I.Mech.E., &c., to be Director of the National Physical Laboratory, in succession to Sir Richard Glazebrook, C.B., F.R.S., who retires on reaching the age limit on September 18.

Since April 1, 1918, the National Physical Laboratory has been under the control of the Department of Scientific and Industrial Research, which was created a separate department in 1916, and has been largely used for research in connection with war operations. Professor Peatvel is Professor of Engineering and Director of the Whitworth Laboratory in the University of Manchester. He is a member of the Advisory Committee for Aeronautics at the Air Ministry. He was educated at University College, London, and undertook scientific research at the Royal Institution and at the Davy Faraday Laboratory until 1898. He was elected John Harling Fellow of the Owens College, Manchester, in 1900, and was scientific manager of the Low Temperature Exhibit of the British Royal Commission for the St. Louis Exhibition, 1904. Sir Richard Glazebrook will complete his 65th year on September 18. His brilliant career as a physicist has been marked by a Fellowship of Trinity, Cambridge, which he has held since 1877; a university lectureship in mathematics and many other academic distinctions; and by the Directorship of the National Physical Laboratory, from which he now retires after holding it for 20 years. His text-books have made his name familiar to all students of science.

Progress of Scientific & Industrial Research

Review of the work of the past year

THE Report of the Committee of the Privy Council for Scientific and Industrial Research for the year 1918-19 (Cmd. 320, 6d.) reviews in detail the work of the Department, and indicates a steady extension of its activities.

It is very naturally urged that the applications of science which proved so fruitful in connection with war work should be continued under peace conditions. During the year steady progress has been made with the formation and development of research associations, and a number of investigations of direct industrial application have already been completed.

Position of "Key" Industries

The Department have given "very exceptional terms" to the British Scientific Instrument Research Associations, because their industry falls wholly within the class of "key" industries. Another industry falling partly into this class is glass manufacture. The making of scientific glassware in this country is essential to the national interests, and can only be developed in connection with the manufacture of other kinds of glass. Accordingly, an arrangement has been made with the Glass Research Association that the Department will guarantee an expenditure of £20,000 a year for five years on condition that the members of the Association raise £5,000 a year during the same period.

The reference in last year's report to the special Government encouragement recommended for certain "key" industries by the Committee on Commercial and Industrial Policy after the war appears to have given rise to some misunderstanding. It has been suggested to the Department that it should make grants at a higher rate than pound for pound to certain industries because other industries are dependent upon them for their welfare or existence, and that these industries should therefore be regarded as "key" or "pivotal." In an old industrial country such as this, where trade has been joined to trade and industry to industry for generations, the resulting structure has become so complex that there are few industries on which others are not dependent to a greater or less degree. Thus, no industry using power can be carried on without the help of the coal industry or the engineering industry, while most industries depend more or less upon the building trade, the chemical industry, the leather industry, or one or other of the textile industries. In a sense, therefore, a large proportion of our trades can be regarded as "pivotal." If claims for exceptional treatment by the Department are to be justified, it is stated, the definition of a "pivotal" industry must be narrowed. This can readily be done by considering the purpose for which the Department's funds are intended. Their sole aim is the stimulation and prosecution of research, and accordingly they can only be made at a high rate to industries for which the cost of the necessary research is great in relation to their means.

The British Research Association for the Woollen and Worsted Industries, which was the first of the textile research associations to come into existence, has made a successful start, and is contemplating as one of its first tasks a thorough investigation of the problems of woollen spinning, a branch of the industry hitherto conducted on somewhat empirical lines. Among the researches conducted by this Association which have already produced results are the following:—(*a*) Action of acids, alkalies, and soaps on wool; (*b*) investigations on the effect of manufacturing processes on textile fibres; (*c*) investigations on the milling of wool; and (*d*) the electrification of fibres.

Progress has been made in the organisation of co-operative research for the leather industries, and a provisional committee, representative of the Leathersellers' Company and of the United Tanners' Federation, is engaged in framing a scheme for a Leather Industries Research Association. A number of industries depending for their raw materials on supplies imported from tropical countries have taken active steps to ensure that the problems arising in their processes shall receive scientific investigation, and accordingly the British Empire Sugar Research Association of British Rubber and Tyre Manufacturers will shortly come into existence. The increased cost of labour has caused the outlook for the shale oil industry to be so anxious that the establishment of the Research Association, which we had approved, has been suspended, although the firms had already paid in their subscriptions. Similarly, the hope expressed last year that the engineers and shipbuilders of Scotland and those of the north-east coast of England would soon be able to combine for the purpose of framing and carrying out a single scheme of co-operative research has not yet been realised, though the movement is still going forward.

Surveying the Field of Research

A factor of very indefinite nature in most industries is the amount and cost of the researches necessary to achieve the end in view, the aim being (i) to make the beginnings of an effective attack on all the principal groups of problems which the raw materials, the processes, the various products, the supply of power, the type of machine in use, the lay-out of factory or the conditions of employment might suggest; (ii) to provide for the rapid distribution of all existing technical knowledge and of any new discoveries to the participating firms; and (iii) to provide a body of skilled scientific and technical advice for individual members who care to seek it and are prepared to pay for work done in their individual interest. Obviously the cost does not depend on the size of the industry, since a comparatively small industry like scientific instrument making may require for success more research and a greater expenditure than an industry like boot and shoe manufacture, which employs a far larger number of persons.

Only a careful survey of the field of research can enable a sound estimate of cost to be made, and consequently the first duty of an industry forming a research association is to devote its attention to making such a survey—first of all in a preliminary way, and then, when the opportunity arrives, more completely. For the complete survey it is necessary to have the services of a competent staff, working under the guidance of a responsible technical officer. The qualifications needed by such an officer have been the subject of much discussion with the representatives of industry, and there is a general feeling amongst them that a director of research should not necessarily be an expert in a particular industry, nor a man who has greatly specialised in a particular branch of science, but a man with a wide knowledge of science, endowed with sympathy and tact, and having a willingness and capacity to learn; briefly, what is needed is "neither a light-armed nor a heavy-armed soldier, but a leader."

Workers under Research Associations

The Council point out that the conditions of employment offered by the associations to their scientific workers, whether directly engaged or attached to a university or college, will need very careful study. The war has made the scientific man realise his vital importance to the community as a means of defence, and a certain class-consciousness has arisen among the younger men, of which account must be taken. The need of the community may be, and we believe is, no less urgent in time of peace. But it is not so insistent, because the processes of peace, owing to their relative complexity, are so much slower, and this fact also must be brought into reckoning. Yet discussion of the terms of employment offered by firms and of the status and remuneration of scientific and technical workers under Government can only do good, and the proposals or criticisms which have recently appeared will no doubt be carefully considered by the research associations. It has been claimed by some that research workers employed by a firm, or a research association, should have the right to patent and exploit for their own benefit any discoveries they may make which their employers may be unwilling to take up. This claim has, at first sight, the appearance of justice, but on the other hand it has been well pointed out that the work done in the research laboratories of firms and research associations is essentially team-work, in which the contribution of each member is part of a whole, and that no arrangement which encourages individuals to play for their own hands is consistent with the well-being of their colleagues or of their employers. The true solution is to be found in the adoption of an enlightened and generous policy by the association or firm.

Closely connected with this matter is the attitude of research associations to the consultant and analyst. The position of the consultant or analyst is one of great importance to the industrial community. The work of this profession ranges from analysis

or testing of a more or less routine kind to research of a high order. Many firms, and even whole industries, have relied entirely in the past upon the professional consultant for such research as they have wished to undertake. It would not be surprising if some members of a profession which has won for itself a reputation for high accuracy and skilful technique, and which includes among its leaders original workers of the highest order, should view with doubt the possible incursion of powerful trade associations into their own field of work. It is accordingly very important that research associations should define clearly, and from the beginning, their attitude in this important matter. We think they will agree, in the first place, not to undertake for their members any routine work of the kind hitherto undertaken by the professional analyst or testing engineer. One of the associations has already agreed to make a panel of consultants and analysts in order to enable its members to obtain technical assistance, which it is not the proper function of a research association to supply. This association acts as a go-between in cases of this kind, and does not inform the inquiring firm which consultant has been employed, or the consultant from which firm the inquiry has come. Whether this is the best procedure we do not presume to say, but we record it as one among several possibilities. The higher range of consulting work is obviously not susceptible of this treatment, but we believe there is no likelihood that original workers among consultants will find their services neglected as a consequence of the establishment of research associations. The reverse is indeed the more probable effect. It will be impossible for even the most powerful and wealthy associations to cover the whole field of investigation opened up by the needs of their industry, and the independent specialist is at least as likely to be called to their aid as the worker in college or university. Moreover, individual firms which are progressive will often need to have problems worked out for their own purposes, some of them doubtless suggested by the work of the association to which they belong.

Research work Carried Out

Among the particulars given of research work already undertaken, it is stated that work on the insulation of refrigerators has begun at the request of the Food Investigation Board, and the specific heats and thermal conductivities of lubricating oils have been investigated in connection with the research into these oils undertaken at the request of the Lubricants and Lubrication Inquiry Committee. Interesting tests have also been made to determine the heat necessary to raise the temperature of certain vegetable oils intended for varnish-making from that of the room to 350° C. Research has also been undertaken into the transpiration of gases through walls for the Building Materials Research Committee. A beginning has been made with the testing of chemical glassware of the highest grade, and it is hoped that the regulations for testing Class B ware will soon be settled. In the Engineering Department considerable progress has been made with the researches into lubricating oils carried out for the Lubricants and Lubrication Inquiry Committee. A complete series of tests in the Lanchester worm gear has been made on a number of selected samples of animal, vegetable, and mineral oils, and reports have been submitted to the Committee. A number of tests into a variety of materials for the Air Ministry have also been completed.

Great progress has been made in the Metallurgy Department with the study of the constitution of the groups of ternary alloys which are likely to prove important for practical purposes, and the possibilities of some of them "which have very remarkable properties have now been placed on a secure foundation." The causes of failure in boiler plates have been further studied, and the results communicated to the Iron and Steel Institute, while much work has been done on the case-hardening and heat treatment of alloy steels. The research on magnet steels has made good progress, and, with a view to placing the study of tungsten steels on a better basis, an investigation has begun into the constitution of the alloys of iron and tungsten.

Fuel Research

In connection with the work of the Fuel Research Board, reference is made to the new research station at East Greenwich. In view of the cessation of war conditions and of the recent developments in the coal mining industry, the Board feel it to be desirable that they should reconsider the whole outlook as regards their researches into the more economical use of the fuel resources of the nation. In a report which they propose to issue shortly they intend to deal with this subject.

On the question of pulverised fuel the Board refer to Mr. Harvey's report on the "Pulverised Coal Systems in America," and state their belief that a further justification for the publication and dissemination of the report has been supplied by the recent developments in connection with the coal industry, one effect of which will be to emphasise more than ever the need for the adoption of more economical and efficient means for the use of fuel in industry. The bare fact that this method is now being applied to the burning of over ten million tons of coal per annum in America is in itself strong reason for its serious consideration in Great Britain. It is hoped that this consideration will not stop short of a close study of the possibilities which it may present of increased efficiency in the use of fuel in many British industries.

On the subject of "power alcohol," the Board suggest that the Government will no doubt give careful consideration to the recommendations of the Committee. Meantime they desire to associate themselves with the view that should any permanent organisation be established, it is of great importance that the arrangements made should be such as to bring the study of alcohol as a fuel into close association with that of other forms of fuel, whether solid, liquid, or gaseous, for the economic factor will in the end inevitably condition the possibilities of its extended application. The price, in other words, will be found to be the decisive element in its use.

Food Investigation

The work of the Food Investigation Board is reported to have grown enormously during the year. The Board have appointed six committees to deal with the different classes of material involved, viz., fish preservation, engineering, meat preservation, fruit and vegetables, oils and fats, and canned foods. These committees have in turn appointed seven sub-committees, while the Oils and Fats Committee have initiated two conferences, one to advise as to known possibilities of replacing edible oils and fats used in industry and to make recommendations for research with the object of liberating edible oils and fats for human consumption; the other to formulate a set of standards for the more common edible oils and fats, including colour, test of free acidity, and tests for oxidation and for rancidity, but excluding "bouquet."

The Fish Preservation Committee have satisfied themselves as to the soundness of the brine-freezing process, "both as regards the scientific principles involved and the complete preservation of the fish which results." The commercial feasibility of the process has still to be established. The relative advantages and disadvantages of gutting fish before freezing are being investigated, but the Committee have suffered in the prosecution of these and other researches into general problems by the shortage of investigators and the necessary dispersal of the work in various centres. These difficulties can only be removed by the lapse of time and the establishment of a suitably equipped headquarters for fish research in a convenient place. In the opinion of the Committee Lowestoft most nearly fulfils the necessary conditions.

The Meat Committee have been giving their attention to an inquiry into the causes of the peculiar sensitiveness of beef to freezing. This work is being conducted at University College, London, and in the cold stores of the Colonial Consignment and Distributing Company, Ltd., under the general supervision of Professor W. M. Bayliss. The results so far obtained promise not only knowledge immediately useful to the cold storage industry, but also a fundamental contribution to the theory of the colloidal state, and a fresh insight into the distinctive colloidal characters of the living substance of the animal and the plant. No less important than the preservation of the fibre of the meat are its diatetic value and flavour as it reaches the consumer. These problems in bio-chemistry are being investigated at Cambridge by Professor F. G. Hopkins.

Edible Oils

The refining of fine edible oils is described in the report as practically a new industry in this country, and a chemical sub-committee has been at work on the many problems involved. The question of discovering substitutes for edible oils used in industry was one of considerable importance during the war, and was entrusted to a special sub-committee, but more recently other problems referred by the Ministry of Food have gained in relative urgency. In particular the distribution of accessory foodstuffs in edible fats of various origin and history is a matter of vital effect upon the health of the masses of the people, and especially of the very young. With the assistance of the Medical Research Committee this important question is now engaging active attention.

Determination of Copper in Ores*

By C. E. van Barneveld and E. S. Lever

MILLING practice at the porphyry copper mines of the South-west is in a transition stage because of the rapid changes following the introduction of flotation. Among the several problems that are receiving earnest attention from the operating companies is the recovery of the copper minerals forming the complex ores of the oxidation zone of the deposits. This problem is under investigation at the Tucson mining experiment station of the Federal Bureau of Mines. A survey of the status of present laboratory practice brought out the need of a correct and rapid method for the selective determination of the quantity of copper in the sulphide form, on the one hand, and of that in the form of combined oxides, carbonates, silicates, and native or metallic copper, on the other hand, in partly oxidised ores and in mill products from these ores. Such a method is necessary for control determinations on flotation mills treating sulphide ores and also on lixiviation works using either acids or alkalines as the active solvent for the copper in oxidized and in silicate form. For convenience such copper is termed " oxidised copper."

The methods in common use for the selective determination of copper minerals are the sulphuric acid method and the ammonia method. Both are unsatisfactory. The sulphuric acid method, in which a 5 per cent. solution of cold sulphuric acid is used to dissolve all the oxidised copper, is unreliable for several reasons. A certain amount of metallic iron is nearly always present in the sample, introduced by the various crushing (mill) and pulverising (laboratory) processes. This metallic iron precipitates more or less metallic copper from the copper sulphate solution formed by leaching with dilute sulphuric acid, thus giving correspondingly low oxidised-copper returns. Another source of error in the same direction is the fact that dilute sulphuric acid dissolves only one-half of the copper present as cuprite (Cu_2O.) A serious source of error in the opposite direction, making for high oxidized returns, is the fact that chalcopyrite, bornite, and chalcocite are more or less soluble in dilute sulphuric acid. Hence, more or less copper in sulphide form is reported as oxidised copper. It sometimes happens that the plus error due to solution of some of the copper in sulphide form is largely compensated by the minus error due to partial solution of cuprite and to deposition of copper on metallic iron. The majority of the ores tested by the writers show high oxidised and low sulphide returns, and check samples show considerable variation.

The ammonia method, in which a 5 per cent. solution of either ammonia or of ammonia and ammonium carbonate is used to dissolve the oxidised copper, is even more unreliable than the sulphuric acid method. Both chalcopyrite and chalcocite when pulverised are decidedly soluble in solutions of ammonia and ammonium carbonate, the finer the material is ground the greater is the degree of solubility. On the other hand, complete solution of the oxidised copper is rarely attained. This defect is most noticeable in ores having a siliceous gangue and in ores carrying chrysocolla. The solvent gelatinises the silica, and it appears that the formation of this gelatinous, spongy mass prevents complete decomposition of some of the copper mineral, in addition to holding dissolved copper during filtration.

Sodium Tartrate Method

While the investigation at the Tuscon station was in progress, an improved method was developed by H. D. Hunt and R. V. Thurston of the research laboratory of the Miami Copper Co. The procedure is essentially as follows :—Place 2 grams of pulp in a beaker, add 20 c.c. of a solution of caustic soda-sodium tartrate and boil the mixture gently five to ten minutes with occasional shaking of the beaker. To the hot mixture add 25 c.c. of a 20 per cent. solution of ammonium sulphate ; heat for ten minutes. Filter ; wash several times with a hot solution of ammonium hydroxide and ammonium sulphate, and finish the washing with hot water. Neutralise the filtrate with sulphuric acid and add 2½ c.c. of concentrated sulphuric acid, then add 2½ c.c. of concentrated nitric acid. The filtrate is now ready for electrolysis.

The first treatment with the solution of caustic soda and sodium tratrate effects complete and rapid solution of the azurite, malachite and melaconite, and partial solution of the cuprite. The rest of the cuprite is dissolved later. The chrysocolla also goes into solution. Care must be taken not to boil to dryness or to a small volume. The reagent must be of sufficient strength to redissolve the copper hydroxide first formed by the action of the solution on the oxidised copper minerals in the sample. The ammonium sulphate solution has a twofold function. It converts the excess sodium hydrate into sodium sulphate, and it forms ammonium hydroxide, which in turn dissolves any remaining cuprite.

The following stock solutions are required :—Sodium hydrate-sodium tartrate solution, consisting of 100 grams of sodium hydrate and 50 grams of sodium tartrate dissolved in 1,000 c.c. of distilled water ; ammonium sulphate solution, consisting of 250 grams of ammonium sulphate in 1,000 c.c. of distilled water ; and ammonia-ammonium sulphate solution for washing, prepared by adding 100 c.c. of ammonium hydroxide and 100 grams of ammonium sulphate to 1,000 c.c. of distilled water.

In testing this method, the writers found that it gives fairly satisfactory results with the low-grade porphyry ores for which it was developed. It is, however, subject to two well-defined inaccuracies. One of these arises from the fact that chalcocite is decidedly soluble in ammonia. Washing with hot solution of ammonia and ammonium sulphate unquestionably dissolves more or less copper in the form of chalcocite from the mass on the filter paper. Several tests were made of 2-gram samples containing 3 to 4 per cent. of oxidised material and varying proportions of chalcocite. Mixtures containing 8, 16 and 24 per cent. copper as chalcocite respectively showed 0.18, 0.33 and 0.45 per cent. dissolved in washing and erroneously reported as excess oxidised copper. Another source of inaccuracy, as regards ores containing chrysocolla, results from the difficulty of washing all the dissolved copper from the gelatinised spongy mass on the filter paper. Mixtures containing 2½ to 3 per cent. copper as chrysocolla showed losses ranging from 0.05 to 0.1 per cent. ; and mixtures containing 5 and 7½ per cent. copper in this form respectively showed losses of 0.33 and 1.42 per cent. These errors tend to balance each other for ores containing both chalcocite and chrysocolla in small amounts. In analyses of ores containing less than 5 per cent. copper, the resultant error is not serious.

Sulphur Dioxide Method

The experiments with the sulphur dioxide method were made with the following requirements in mind :—

1. The method must be applicable to a wide range of ores, and must be thoroughly reliable and rapid.
2. Copper sulphides, especially the more easily decomposed chalcocite, must not be affected by the reagent used.
3. Metallic iron must not affect the determination.

The method evolved is based on a large number of experiments which show conclusively that cuprite, melaconite, malachite, azurite and chrysocolla, when finely pulverised, are readily and completely soluble in sulphur dioxide solution. As certain copper silicates resist the action of strong, hot sulphuric acid, a careful investigation was made of the action of sulphur dioxide. Specimens of chrysocolla from various sources and selected samples of copper silicates representing all the large mines in the South-west were treated with sulphur dioxide solution and the copper in every sample completely dissolved ; not a trace of copper could be found in the residue. Any finely divided metallic copper present in the sample is likewise dissolved. Copper sulphides are not attacked, no matter how finely pulverised the mineral may be, nor how long the time of contact. The three essential features of the method are as follows : (1) Fine pulverisation to free completely the particles of copper minerals from the gangue ; (2) keeping the powdered mineral in suspension by shaking or rolling during the lixiviation or solution period ; (3) using sulphur dioxide solution (sulphurous acid) and not sulphur dioxide gas.

The procedure in the sulphur dioxide method is as follows :—

Place 2 grams of pulp ground to a fineness of 100 to 150 mesh in a bottle, add 100 c.c. of a 3 per cent. solution of sulphur dioxide. Seal the bottle and agitate by rolling one-half to two hours. Filter ; wash the residue with sulphur dioxide solution ; add the washings to the filtrate, which will contain in solution all oxides, carbonates, and silicates of copper and all metallic copper. Add

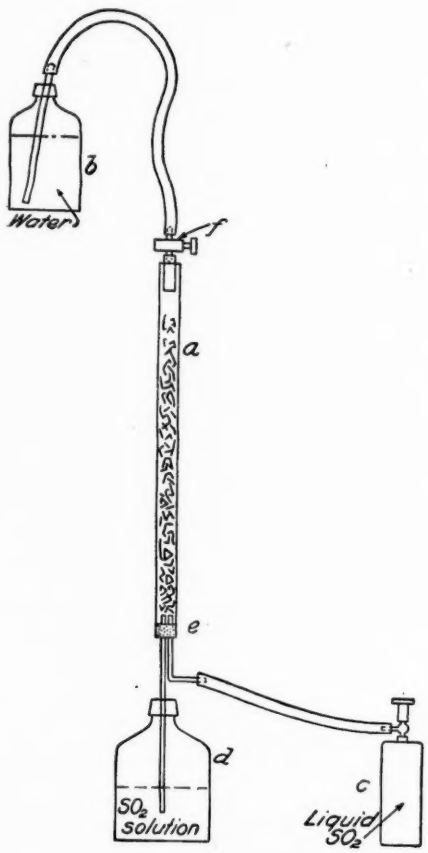
* Abstract of Paper No. 198 issued by U.S. Bureau of Mines.

5 to 10 c.c. of nitric acid. Boil down to 20 c.c. Dilute with distilled water to 150 c.c., and determine the copper by the electrolytic method in the usual way.

The residue from filtration contains the unaltered and undissolved copper sulphides. In the experimental work the copper present as sulphide was separately determined in order to check the determination of oxidised copper. Ordinarily this step would not be necessary. In analyses of the low-grade porphyry copper ores of the South-west, the sulphides may be readily decomposed and all the copper dissolved by proceeding as follows :—To the residue, add 5 c.c. of sulphuric acid and 10 c.c. of nitric acid and boil until dense white fumes appear. Add 5 c.c. of nitric acid and dilute with distilled water to 150 c.c. Determine the copper by the electrolytic method. This method of determining copper in the residue is not suited for heavy sulphide ores containing interfering bases, and for such ores standard methods should be used.

Preparation of Solution

Although sulphur dioxide solution (sulphurous acid) may be readily purchased, it is decidedly unstable; hence the solution



should be prepared in the laboratory as needed. Small quantities are easily made by adding moderately strong sulphuric acid to scrap copper tinned on one side; the resulting sulphur dioxide gas is absorbed in water. For continuous work it is better to purchase liquid sulphur dioxide in steel cylinders and drums. In the first experiment at the Tucson station the sulphuric dioxide gas was introduced directly into the bottle containing the water and pulp. Much loss of gas resulted and the procedure was otherwise unsatisfactory.

Later the simple apparatus shown in the figure was evolved. A vertical absorption tower *a*, 42 in. long, made of ¾-inch to 1-inch glass tubing and filled with broken hard-burned fire-clay, is set between two glass bottles *b* and *d*, of 3 to 5 gallons' capacity, the bottle *b* being placed about 5 ft. above the other bottle. This tower is open at the top and sealed at the bottom with a plug of sealing wax *e*, through which two small glass tubes extend. The upper bottle *b* contains distilled water, which is siphoned into the upper end of the absorption tower, the flow being regulated by a stopcock *f*. A cylinder *c* (capacity 6 to 50 lb.), containing liquid sulphur dioxide, is connected to one of the glass tubes extending into the absorption tower. On opening the valve of this cylinder the liquid sulphur dioxide issuing from the valve is gasified by the reduction in pressure and passes into the tower, where it is absorbed by the water from bottle *b*, converted into sulphur dioxide solution of the desired strength and caught in the stock bottle *d*. This apparatus gives entire satisfaction. With little attention, a 3 per cent. solution of sulphur dioxide may be produced at the rate of 3 litres per hour. The cylinder containing liquid sulphur dioxide indicated in the sketch may be replaced with an SO_2 gas generator.

Strength of Solution

Considerable variation as regards strength of solution and time of contact will be necessary in treating different ores from different localities. In general, for porphyry copper ores a solution containing 3 per cent. sulphur dioxide should be used. With some ores much weaker solutions, containing as low as 0.75 per cent. sulphur dioxide, will do the work. Merely introducing the pulp into the solution, shaking the bottle for a few minutes, and letting it stand, will not dissolve the copper; constant agitation is essential. For a small number of tests a bottle-agitating machine will give satisfactory results. For analytical work, where large numbers of samples are run, as in a mine laboratory, a bottle-rolling machine will be found more satisfactory, not only for this purpose, but for all solutions requiring constant agitation. The time of contact necessary to completely dissolve the oxidised copper minerals was found to vary from one-half to two hours. Most of the ores and products tested gave complete recovery in half an hour, and the most refractory ores yielded in less than two hours.

Comparison with Other Methods

It has been found that, compared with the sulphur dioxide method, the results for oxidised copper are high with the sulphuric acid method and low with the ammonia method. The sodium-tartrate method uniformly shows returns slightly lower. The uniformity of results for oxidised copper by the sulphur dioxide method is evident. The results with the sodium-tartrate method, which was developed on this class of ore, show more variation and are slightly lower. The sulphuric acid method shows high returns, which are progressively higher for the finer sizes. Results with the ammonia method are low and show considerable variation.

Enough work has been done with the sulphur dioxide method to substantiate the following claims :—

1. Cuprite, melaconite, malachite, azurite, chrysocolla, and fine metallic copper are dissolved rapidly and completely.
2. Chalcocite and chalcopyrite are not affected.
3. Metallic iron in ordinary quantities, even up to 2 per cent., dissolves rapidly and has no effect on the determination, provided there is a strong excess of SO_2, introduced as SO_2 solution.
4. There is no gelatinisation of silica, and the possible loss of copper from this cause, noted in analyses by the other methods described, is eliminated.
5. The method is applicable alike to high-grade and to low-grade ores. The manipulation is simple and the possible sources of error are few. One chemist can keep a 6-unit electrolytic outfit working to full capacity on porphyry ores.
6. Crushing fine enough to liberate completely the mineral particles is essential. Ores containing an appreciable proportion of chrysocolla should always be pulverised to 150 mesh.
7. Any metallic copper present, as flakes or large particles would, of course, be removed during the preparation of the sample and treated as scales. Fine metallic copper remaining in the pulverised sample would be dissolved and reported with the metallic copper. If a separate determination of metallic copper is considered necessary, this can be made by amalgamation, preferably in an amalgamated copper pan.

THE RESEARCH SCHEMES of the British Dyestuffs Corporation now in hand will, it is stated, cost hundreds of thousands sterling. At present there is one group of research laboratories in Yorkshire and another in Manchester, while research colonies have been established at the Universities of Leeds, Oxford and Liverpool. These are under professors of organic chemistry, and special experiments are carried out.

English Oilfields, Ltd.

Attractive Picture of Company's Prospects

At an extraordinary general meeting of British Oilfields, Ltd., on Monday, it was unanimously resolved, on the motion of the chairman (Sir James Heath), that the capital of the company be increased to £1,500,000, by the creation and issue of 1,200,000 new shares of £1 each, ranking equally with the existing 300,000 shares.

Dr. W. Forbes-Leslie, in speaking to the resolution, described the company's position to-day. Your land area, he said, has increased by several thousand selected acres as the result of extending the drilling programme; our technical knowledge of the oil shale formation has increased in proportion; our drills have demonstrated not only an extension of the field on certain well-defined lines—they have also demonstrated that the thickness of the productive oil measures is not penetrated at 300 ft. from the surface, and may even extend to 400, 500, or 700 ft. We have proved more than 20 square miles to contain the oil shale seams, and that in all this great area the thickness of the retortable materials is not less than 150 ft., and that the regularity of the formation in oil contents and in relative thickness of seams is so remarkable that in borings 12 miles apart the relative thickness and oil content is practically the same. This is a most important feature. It demonstrates that the seams are not patchy, and that wherever the seams have not been removed by past terrestrial conditions, you can assess their values and tonnage with absolute certainty.

The drills have also demonstrated the presence of substances which were not suspected to exist in the measures. Thus, in one of our borings, we passed through about 70 ft. of a substance which yields large percentages of wax. It is the so-called ozokerite of Norfolk. Its yield in wax is so remarkable that I hardly care to deal with it in this *résumé*, but its value will very greatly increase the returns the shareholders will obtain from production. (Cheers.) We have since found this stratum of ozokerite in other holes, and may presume with considerable certainty that it underlies the whole of the 20 square miles already proved. Other and interesting substances have been encountered, and we are at present busy in determining their value.

Mining Operations

We have found that mining in the shale series is economical, cheap roofs and floors being available, and the structure of the seams giving natural facilities for mining.

Another point demonstrated was that the upper or sulphurous series was separated by a well-defined hiatus, or break in the sequence of deposition from the middle shales, a period which may have lasted hundreds of thousands or even millions of years, and that the middle shale series was practically free from sulphur. It was in general terms a non-sulphurous series. The oil obtained from the middle shales is an oil of remarkable quality, practically free from sulphur and yeilding many valuable by-products, and especially rich in motor spirit and wax.

This discovery, first made in mining operations, and finally worked out in the laboratory, and in commercial tests, transformed at once the whole business into one of first-class importance. The enormous tonnages of these middle shales proved to exist by the practical demonstration of the drill throughout your area, amounting on conservative estimates to more than 2,000,000,000 tons, practically free from sulpur, containing in the laboratory from 50 to 80 gallons per ton of oil, and from 60 lb. to 112 lb. of sulpate of ammonia, besides 15 per cent. or more of fine parffin wax, and other valuable by-products could not fail, because of its magnitude, and the necessities of the United Kingdom in raw fuels, to create in the Press and among investors considerable interest.

I originally estimated commercial production at 39 gallons per ton. But in consequence of the yield from mined minerals shales being so much richer than drill records formerly demonstrated, I have good reasons for considerably raising my estimate, and now estimate that a yield commercially of from 45 to 50 gallons of oil per ton treated may be expected. The yield of sulp ate of ammonia may be anything to or over 60 lb. per ton of shale, and the wax about 60 lb. per ton. These are rising figures, but they are not without a basis in fact. In your oilworks at Setch, long and careful experiments have been carried out on the best types and form of retorts. We have found several types suitable for profitable production, but until the last and quite different type, embodying the lessons we have learned previously, we have not been personally satisfied that the object sought—namely, quality of oil, conservation of by-products, maximum yield of wax, and cheapness of construction—had been comparatively attained. All tests to date, I am glad to say, point to the last retort being satisfactory, with certain minor alterations.

There are two corollaries still to be dealt with under by-products. The first comprehends the discovery and present development of a very valuable deposit of clay, within 600 yards of the main railway line to London. This deposit has a thickness of 40 ft., and bricks of a quality unsurpassed in England can be manufactured out of the clay—also Staffordshire blue brick.

The second corollary comprehends cement manufacture as an integral part of the company's business, the residues of the shale being found to make good cement, when mixed with the lower chalk so plentiful in your properties. The fact that your waste gas, of which you will have enormous quantities available, can be utilized for fuel, makes the manufacture of cement so economical that no other centre of manufacture which relies on coal for fuel can favourably compete. It is possible you will be turning out 600 tons of cement per day when your 1,000-ton shale plant is in full working order.

Chemical Trade Inquiries

The following inquiries, abstracted from the "Board of Trade Journal," have been received at the Department of Overseas Trade (Development and Intelligence), 4, Queen Anne's Gate Buildings, London, S.W.1. British firms may obtain the names and addresses of the inquirers by applying to the Department (quoting the reference number and country), except where otherwise stated.

Locality of Firm or Agent.	Materials.	Ref. No.
Ceylon	(*a*) Rubber manufacturers, (*b*) Copra, cinnamon, citronella oil, desiccated cocoanut, (*c*) Plumbago	514
Austria	Drugs and medicines	516
Italy	Zinc. Replies to the Secretary, the British Chamber of Commerce for Italy (Inc), Via Silvio Pellico, 12, Milan.	
Argentine Repub.	Dyes, &c.	544
Roumania ..	Pharmaceutical and chemical products	577
Belgium	Chemical and pharmaceutical products, and specialities, &c.	565
Canada	High grade felspar, phosphate and pyrites. Replies to Canadian Government Trade Commissioner's Office Portland House, 73, Basinghall St., London, E.C. 2.	
Egypt	Glassware, dyes and soap	559
Germany (occupied Territory)	Oils	575
Brazil	Cement, glassware, chemicals, drugs and dyes, oil seeds and fibres ..	585
Chile	Aniline dyes	587

Contracts Open

Bermondsey.—(13) Soap, (14*a*) oilman's goods, (14*b*) disinfectants, &c., (15) oils, colours, paints, &c. Particulars from Mr. Henry H. Reeve, Clerk to the Guardians, 283, Tooley Street, S.E. 1. Tenders by 6 p.m., September 25.

Edmonton.—Drugs, druggists' sundries, soap, disinfectant, oilman's goods. Particulars from Mr. F. Shelton, Clerk to the Guardians, White Hart Lane, Tottenham, N. 17. Tenders by 9 a.m., September 15.

Greenwich.—Oilman's goods, soap. Particulars from W. C.

Cornish, Clerk to the Guardians, Clerk's Office, Board Room, East Greenwich, S.E. 10. Tenders by noon, September 18.

WESTMINSTER.—Oilman's goods, soaps, drugs, petrol. Particulars from Mr. W. J. Vickley, Clerk to the Guardians, Guardians' Offices, Prince's Row, Buckingham Palace Road, S.W. 1. Tenders by 12 noon, September 17.

FARNHAM.—Oilman's goods, soap. Particulars from the Master of the Workhouse, Farnham. Tenders by noon, September 17.

CHELSEA.—Drugs, oilman's stores. Particulars from the Secretary, Chelsea Hospital for Women, Arthur Street, Chelsea, S.W. 3. Tenders by September 19.

LAMBETH, S.W.—(*b*) Disinfectants. Particulars from Mr. H. E. Anderson, Borough Engineer. Tenders by 12 noon, September 18.

MANCHESTER.—Drugs, &c. Particulars from Public Health Office, Civic Buildings, 1, Mount Street, Manchester. Tenders by September 10.

POPLAR.—Manures. Particulars from Mr. H. E. Dennis, Clerk, Guardians' Offices, Poplar, E. 14. Tenders by 6.30, September 17.

CORK.—Lubricating and other oils, glass, cement. Particulars from City Engineer's Office, City Hall. Tenders by 2 p.m., September 12.

GLASGOW.—Oils, rubber. Particulars from Mr. J. Ford, secretary, 19, Hope Street, Glasgow. Tenders by September 20.

HAMPSTEAD.—Soap. Particulars from Mr. H. W. Preston, Clerk, New End, Hampstead. Tenders by September 17.

Work in Prospect

BURNLEY.—Plans have been passed for a petrol store at Healey Wood Road for the British Petroleum Co., Ltd.

HALIFAX.—Plans have been passed for an extension to the chemical works at Farrar Mill, Haigh Lane, Southowram, belonging to A. Goodall & Co., Ltd.

HAYLE.—A beet sugar factory to employ 1,000 hands is proposed at Hayle (Cornwall).

TRURO.—Plans have been passed for an oil store at Newham, for the Anglo-American Oil Co.

Government Held Patents

Some Notes by the Research Department*

THE holding of patents by Government on any large scale undoubtedly raises many difficult questions, particularly if it is sought to protect inventions abroad. The question of how best to deal with foreign patents is peculiarly difficult. It is a problem in which the Department is as directly interested as the research associations. Indeed, the question of patenting abroad is a more embarrassing one for the Government than for private or semi-official corporations, for if the Government were itself to hold foreign patents it might easily become involved, if the discovery were a valuable one, in international controversy. We gather that the usual practice, in cases where secrecy has not been essential, has hitherto been to allow inventors in the service of the British Government to take out foreign patents in their own names and for their own interest, and to include this right as part of the reward for their discovery, while the British patents may either be vested in the Minister responsible for the Department concerned or otherwise dealt with according to circumstances.

But this is obviously not an altogether satisfactory method, for it might well happen under peace conditions that a discovery made in this country would be most advantageously or indeed exclusively produced in a foreign land. The difficult question as to the wisdom of calling the attention of foreign countries to a British discovery by applying for a patent having been answered affirmatively, the important question of finance still remains to be faced, for the successful maintenance of a foreign patent may involve the expenditure of large sums of money.

Accordingly some device seems to be called for, both in the case of Government and of research associations, which would enable foreign patents to be taken out in a wider interest than that of the discoverer, but which would avoid the special difficulties to which we have referred. It may be that different procedures will be necessary for the two cases, but if an organisation could be devised which would deal with both it would undoubtedly be preferable. But it is by no means easy to determine the best procedure in the case of discoveries made with the aid of Parliamentary funds, even when patenting abroad is left out of consideration.

We understand that the American Government have felt the same difficulties, and that up to the present a great variety of practice is tolerated. In some Departments of the United States Government no patents at all may be taken out; in others complete freedom is left to the inventor to patent in his own name, and to maintain his rights even against Government. In other cases the patentee has to transfer his "home" rights or they are otherwise controlled, but he is allowed complete ownership of foreign rights. In still other cases the American discoverer working under Government is compelled to dedicate all rights in his inventions to the public. At present it is impossible for the United States Government to act as assignee of any patents, and where rights have been transferred in the past they have been made over to a Minister in his personal capacity.

To remedy this state of things a Bill was recently introduced in the Senate authorising the Federal Trade Commission to accept and administer for the benefit of the public and the encouragement of industry, inventions, patents, and patent rights. The Commission had been entrusted by the President during the war with the licensing of enemy-owned patents to American corporations and citizens, and it was thought that the experience gained in this regard would form a useful basis for the duties proposed to be imposed upon it by the Bill. It is understood that in the coming session of the Senate the Bill will be re-introduced. But it gives the Commission no power to receive donations of patents or patent rights.

In this country, as in America, there is no central authority entrusted with the duty of holding and administering patents taken out under Government and no agreed uniformity of practice. No worker under this Department may patent a discovery except with the leave of the Committee of Council, and where leave is given, the patent is taken in the joint name of the inventor and the Imperial Trust for the Encouragement of Scientific and Industrial Research. The Department reserves to itself complete discretion in the administration of the patent rights after consultation with the inventor. When a worker, engaged in research under a committee or board of the Department or in receipt of grant from the Department, desires to take a patent he must do so in conjunction with the Imperial Trust, but in these cases the Trust reserves the right to refuse to be a party to the patent. So far the procedure is simple, and it might possibly be extended to other Departments. But at this stage the real difficulties begin.

Apart from the embarrassments inherent in foreign patents, to which we have already referred, a number of special considerations arise before a decision can be reached on the advisability of patenting, for the Government cannot proceed with the single eye to financial advantage which commercial undertakings rightly use. So far we have provisionally decided that patents should not be taken for (*a*) inventions of value for the preservation of health or of life, or (*b*) inventions the use of which can be enforced by a Government Department. In these cases steps are taken to secure full and complete publication, with a view to preventing others from securing a patent for the invention. The strong professional tradition of the medical profession in this country has led us to refuse patent rights in the first class of case, and there are obvious reasons of expediency for refusal in the second.

But we are aware that reasons can be urged for a different practice, and we think they should receive full consideration. American and Canadian opinion leans to the view that the refusal to patent has serious disadvantages, since in the absence of a patent a manufacturing firm has no incentive to work the invention. And there is little doubt that this is true in those cases where the invention needs further development before it can be placed effectively on the market, and in those cases where no effective demand for the invention exists in the absence of an active commercial campaign. Where, on the other hand, a powerful profession can push a new discovery, as in the case of therapeutic or sanatory discoveries, or where a Government Department can enforce its use, these considerations lose much, but by no means all, of their weight. The whole question needs careful watching and discussion by those best able to form a judgment.

We are constantly receiving applications from inventors who wish to be placed in touch with firms likely to exploit their discoveries, but we are obliged to inform them in all cases that this is a service it is impossible for us to render.

* From the new report of the Industrial and Scientific Research Department.

From Week to Week

OIL-BEARING SLATE BEDS have, according to a Reuter's message from Berlin, recently been discovered in the Province of Hanover.

WE ARE INFORMED that Messrs. Dexine, Ltd. (Dexonite), will have Stand No. 268 at the Shipping, Engineering and Machinery Exhibition, which is to be opened at Olympia on September 17.

THE ANNUAL BUSINESS MEETING of the Chemical Industry Club will be held on Monday, October 20. The first annual dinner of the club has been arranged for Friday, October 31.

AN EXTENSIVE FIRE, causing damage estimated at over £400,000, has been caused by an explosion in the petrol depôt at the American camp near Dijon.

A NAPTHA STILL, containing ten tons of naptha, caught fire at the chemical works of Messrs. Hardman & Holden, Ltd., Crabtree Street, Blackburn, on Saturday. Fortunately the fire did not spread, and was extinguished in half-an-hour.

IT IS STATED FROM BERLIN that an important oilfield has recently been discovered at Bloh, in Oldenburg, where a big flow of oil followed the first boring. The necessary installations are being set up.

AT AN INQUEST AT WALLASEY on a man who was killed by an explosion on a vessel, it was stated that the explosion was caused by the man's use of calcium carbide instead of caustic soda for cleaning the ship's boiler.

THE LINCOLNSHIRE FARMERS' UNION have passed a resolution protesting against the exportation of chemical manures needed at home. It may be mentioned in this connection that the export of sulpate of ammonia is already stopped.

IT IS REPORTED from Berlin that the German Government has undertaken to supply Great Britain with 22,000 tons of potash by the end of the present year. It will be remembered that the Anglo-German contract is for 40,000 tons.

RAMSEY WATER WELLS, near Peterborough, which continue to yield oil, have been visited by experts engaged in recent Norfolk borings, and there is a likelihood of developments in the near future. It is now suggested that borings should be sunk between Ramsey Winch and King's Lynn.

MR. ALFRED WOOD, Secretary of the British Sugar Beet Growers' Society, will proceed to France shortly to visit certain sugar beet factories and to secure information from experts with regard to the working and prospects of the industry there. The French sugar estates suffered severely during the war, 150 factories being destroyed by the Germans, and the French Government intend to rebuild on up-to-date lines.

THE RESULT OF THE BALLOT among the members of the Amalgamated Society of Dyers, Bleachers, Finishers, and Kindred Trades for the position of general secretary of the society, in succession to the late Lord Mayor of Bradford (Alderman Joseph Hayhurst), resulted in the appointment of Mr. William Rushworth, the Scottish District secretary, whose headquarters are at Glasgow, by a majority of 6,370 over the applicant who came next on the list. Mr. Rushworth is a native of Bradford, and is about 39 years of age.

OLIVER MARSH, chemist, 89, Liscard Road, Liscard, was summoned at Wallasey, last week, for selling a drug borax, which was adulterated in excess with twenty parts per million of arsenic. Mr. Marsh said the customer did not ask for borax used for medicinal purposes. Of the latter kind he had not sold a pound for the last year. He sold about 20 lb. in a year of the common borax for laundry purposes. Mr. Raffles Bulley, in imposing a fine of 20s. and the analyst's costs, said the chemist should ascertain which borax customers wanted.

THE AMERICAN CELLULOSE MANUFACTURING CO. is busy with extensive preparations for the construction of an entirely new plant on the site of the industry now being developed at Amcelle. The cost will be in excess of $2,000,000 and may amount to as much as $3,000,000. These developments are the result of a contract entered into recently by the Cellulose Co. with the Motion Film Co., of Pathé Freres, to manufacture all the films used by the motion picture concern. About 1,000 men and women are to be employed.

A COMMITTEE OF THE AMERICAN CHAMBER OF COMMERCE IN LONDON has passed the following resolution :—" While it is understood that the British Government is fully justified in protecting home industries to the greatest extent, we venture to suggest that consumers should also be considered, and inasmuch as salicylates, phenacetin, vanillin, phenolph-thalein, coumarine, &c., have practically doubled in price since the import restrictions were in force, the Chamber would respectfully suggest that licences be more freely granted commensurate with the laws of supply and demand, as quantities now being manufactured here are inadequate to meet the demand."

THE TRADE RETURNS OF HONGKONG for the first quarter of 1919, compiled by the statistical Branch of the Imports and Exports Department, Hongkong, show that aniline dyes were imported to the value of £18,774, as against less than £7,000 for 1918; but some merchants question the accuracy of the latter figure. American firms are devoting much attention to this business, and by the distribution of samples and practical demonstrations of the method of using their products, are steadily improving their position in the market. The high price of coal greatly encouraged the use of liquid fuel, imports of which are valued at £76,435. It is stated that the local demand for this fuel considerably exceeds the supply.

A NATIONAL SETTLEMENT was reached last week in the dispute between employers and workpeople in the drug and chemical industry. The employers have agreed to offer as from August 1, apart from the 5s. advance on the minimum rates, a 5s. advance on the earnings of all male employes, except those who are receiving 15s. above the minimum rates, and these will receive such advances as will bring them up to 20s. above the minimum rates. No agreement had been come to with regard to any advance in wages for women, but the unions concerned have agreed to recommend their members to accept the offer of the employers, reserving to themselves the right to raise the question of the women's wages at an early date.

A 10,000 MILES TRAVELLING TEST of benzol as a fuel for motor-vehicles began last week, when a start was made from the office of the Automobile Association and Motor Union, Fanum House, Whitcomb-street, W.C. The object of the test is to encourage the use by motorists of home-produced benzol, which is cheaper than petrol. It is urged by the Automobile Association that if the gas-making industry instals the most modern methods of treating coal, enough benzol can be produced to provide, at all events, for all private cars in the country. The 10,000 miles journey will take 10 weeks, and almost every part of the United Kingdom will be visited. The Auto-Cycle Union is also promoting a six-days' competitive test for motor-cycles with benzol. This will begin on Monday, September 15, and the conditions include provision for competitors who elect to use home-produced benzol.

THE COMMITTEE OF ENGINEERS who have undertaken to prepare a scheme for the James Watt School of Research, have decided upon new sources of power as the most important problem to be investigated. " There is latent power," they state, " in nearly everything; the problem is to convert the power to ordinary commercial needs. We have to go very much further than Watt, who was eminently successful in converting coal through steam into power. There is a wonderful future before any nation or man who can evolve a cheap power from some other source than coal, or any source of power not yet tapped. All big employers carry big experimental departments. Therefore, the James Watt School of Research should be made a communal institution for the investigation of basic principles of prime movement for the benefit of all British industries, and thus largely assist in removing the difficulties at present facing British world trade."

A NEW ASPHYXIATING GAS has been reported to the Academy of Sciences by Dr. Roux, Director of the Pasteur Institute. It is a very important discovery for the prevention of disease as carried by bugs, and for the thorough disinfection and riddance of all rooms of these insects. Experiments were made by Dr. Roux's helpers with a view to finding a sure means of destroying bugs in barracks, hospitals and schools. They began operations in a room of seventy-five cubic métres and containing eight beds, by making gaseous concentrations of chloropicrine. The application of this asphyxiating gas was ten grammes per cubic métre, and at the end of four hours all insects on the beds, on the floor, and on the walls, were dead. It was a clean sweep; not a single insect survived. Chloropicrine is not sold in the shops at present, but can be had from the military services at a low price. This new asphyxiating gas, devised for cleansing buildings after the war, is capable of wide application, and will no doubt be welcomed wherever these loathsome and dangerous pests are to be found.

The Indian Market

(From Our Own Correspondent.)

Trade Activities

During May the imports into Burma increased to Rs. 11,660,000, or 61 per cent. more than the corresponding month last year. The increases were in metals, soap, salt, machinery, paraffin wax, wolfram ore, &c. In India, railway charges in concentrated manures are to be kept as low as possible. and special consideration will be given to applications for reduced rates. At present, manures of all kinds, including chemical manures, are booked at rates between the specially low fixed maximum and minimum of $\frac{1}{3}$ and $\frac{1}{16}$ of a pie per maund and per mile respectively. [Note.—12 pies equal an anna (a penny); a maund equals 82$\frac{2}{7}$ lb. avoir.] These rates are at railway risk. Reduction in freight would lead to greater utilization of manures.

Articles in Active Demand

The following are being energetically introduced:—

American temperature instruments for indicating, recording, and controlling.

English standard colours, pure and unadulterated, for cotton, woollen, silk, straw paper and leather goods; lake and food colours, sulphur black, sulphur blue and sulphur khakis. Congo red, methyl violet, Victoria blue, Chinese blue. Direct browns, blues, green and orange. Vat blue, algol yellow. Acid colours.

Heavy chemicals for dyeing, bleaching, finishing, leather, paper and soap manufactures. Sulphate of aluminum, brown sugar of lead, arseniate of soda, aluminate of soda, sodium sulphide, chrome alum, antimony salt, hematine crystals, negrosene cystals, B. napthal.

English dyes for mills. Sulphur colours, black, direct blue, sky-blue, brown, green, brilliant green, Corinth. Direct colours, blue, dark blue, fast blue, black, violet, dark green, orange, orange brown, and fast red.

Chemical preservatives for covering exposed iron, cement and wood work used on marine, railway and engineering works.

Oxygen (guaranteed purity, 98 per cent.), compressed in cylinders for oxy-acetylene welding and medicinal purposes.

Norwegian calcium carbide.

Foreign Enterprise

In support of the International Exposition of Asiatic Products, to be held at the Grand Central Palace, New York, in the spring of 1920, it is pointed out that the commercial relations of the United States with Asia and Oceania have expanded enormously during the war. Imports valued at 315,176,000 dollars in 1914 increased to 1,041,899,000 dollars in 1918, and exports from 176,402,000 dollars to 603,063,000 dollars. The American dealers' problem is: "How shall the trade gained be retained, and the trade which is capable of indefinite expansion be further increased?" The answer is by simplifying the exchange of commodities, and making the import trade a matter of direct business. No customs duty will be charged on Indian goods exhibited at the Exposition. The exhibition is expected to give a tremendous stimulus to Asiatic commerce in America. Powerful American banking organisations are already established in India.

Japanese machinery is being introduced into India, for spinning and weaving, flour mills, cement mills, sugar mills, paper mills, oil mills, rubber mills, soap making, clay working, glass making, tobacco factories, &c.; also Japanese "brands" of calcium carbide.

The Scotsman in India

India owes much to Scotland. The Scot is a plodding pioneer, and much of the industrial prosperity of India to-day is due to the skill, perseverance and finance in past years of that Highland race. There are more Scotsmen in India than any other white race. They are the type of men wanted. An eminent Scottish firm, that has been in this market for quarter-of-a-century, announces: "X——'s made for India, Burma, and Ceylon, are the result of continuous scientific research on the part of our chemical staff and the outcome of a close study of the varied requirements of the market and the varying climatic conditions in India." This firm distributes from Calcutta, Bombay, Karachi, Madras, Rangoon and Colombo. This is the right spirit for capturing Indian trade, and should be borne in mind by those who contemplate opening their own Indian branches and factories.

The monthly wages paid to native workmen in factories may prove interesting: Boiler mistry or foreman, Rs.25; engineman, Rs.39; oil man, Rs.10; head carpenter, Rs.61; boiler man, Rs.15; carpenter, Rs.16; blacksmith, Rs.26½; fitter, Rs.20½; tinsmith, Rs.18½; mixer, Rs.9½; spare hands, Rs.10; dyer, Rs.9¾; storemen, Rs.9; messenger, Rs.8; unskilled labourers, Rs.8; &c., &c. Compare these monthly wages with those paid in Britain. [A rupee equals 1s. 4d.]

Cotton Expansion and Recent Flotations

The Chemical and cotton industries are closely allied. India has 231 cotton mills, as follows: In Bombay, 165; Central Provinces, 10; Madras, 12; Punjab, 3; United Provinces, 15; Sind, 1; Bengal, 10; Ajmer-Merwara, 2; Delhi, 3; Hyderabad, 3; Central India, 5; Mysore, 2.

Among joint stock companies recently registered under Indian laws are: Salsette Industrial Corporation, Bombay, textile fibres, capital, Rs.1,250,000; Mitchell & Co., Delhi, cotton and silk, Rs.2,000,000; F. A. Sheeham & Co., Calcutta, textile machinery, Rs.500,000; Sovabazar Co., Calcutta, jute, Rs.250,000; Birla Mills, Bombay, cotton, Rs.1,225,000; Ahmedabad Fine Spinning and Weaving Co., Ahmedabad, Rs.700,000; E. D. Sassoon United Mills, Bombay, cotton silk, Rs.30,000,000; Indian National Cotton Mills, Calcutta, cotton, Rs.750,000; Century Mills Co., Calcutta, jute, Rs.7,500,000; West Press (Sulkea), Calcutta, jute, Rs.500,000; Ocean Jute Press, Calcutta, Rs.600,000; &c., &c. The area under cotton is 20,497,000 acres; and jute, 2,497,214 acres.

The Science of Distribution

The shipper in Britain to-day has to fight a triangular commercial battle in this market. His rivals are America, Japan, and the Swadeshi movement, each being different. The demand on the spot is for fresh goods and prompt delivery. This can be satisfied by holding stocks in the country, either by a local agent or a branch of the shipper's business. The fashion is the latter, as expenses can be kept at a minimum, local requirements studied, accumulations of stock prevented, payments for shipments arranged, and the jealousy of competitive agents thwarted. It is an important strategic problem, and includes the protection of "brands" and patents.

The Institute of Metals

An important addition has just been made to the list of papers to be presented at the annual autumn meeting of the Institute of Metals in Sheffield, on Wednesday and Thursday, September 24 and 25. As originally published the list included nine papers; there are now ten, the latest communication being a note by an American metallurgical engineer, Dr. Zay Jeffries, of Cleveland, Ohio., on "The Micro-Mechanism of the Ageing of Duralumin," a subject of great practical interest to all concerned with the working or use of an aluminium alloy that has played a vastly important part in aeronautical engineering during the war.

Dr. Jeffries has come over to this country in order to be able to present his communication in person to the Institute at its Sheffield meeting, at which a record attendance of home and overseas members is assured Copies of the note are now in the press, and will be forwarded to all members and applicants for membership, upon application being made to Mr. G. Shaw Scott, M.Sc., Secretary, Institute of Metals, 36, Victoria Street, S.W.1.

Coal Transport Re-organisation Scheme

The Board of Trade announces that, with a view to assisting in the restoration of normal conditions, it has been decided that the restrictions imposed on the transport of coal by rail under the Coal Transport Re-organisation Scheme shall be suspended as from September 1 until further notice. In order to give effect to this decision a general permit has been issued, and it will not be necessary until further notice to apply for permits in individual cases after the above date. This decision does not affect the instructions at present in force to suppliers of coal as to the maintenance of supplies to their existing customers.

References to Current Literature

Only articles of general as distinct from specialised interest are included and given in alphabetical order under each geographical subdivision. By publishing this digest within two or three days of publication or receipt we hope to save our readers time and trouble; in return we invite their suggestions and criticisms. The original journals may be consulted at the Patent Office or Chemical Society's libraries. A list of journals and standard abbreviations used will be published at suitable intervals.

British

ACIDS. The manufacture of sulphuric acid and nitric acid. J. H. M'Feeters. *South African Eng.*, August, 150-151. A brief description of the acid plant at the works of the Sulphide Corporation.

CARBONISATION. Coal carbonisation—saving the products. *Daily Telegraph*, September 1. An account of the "Carbocoal" process.

COKE. The calorific value of commercial coke and coke breeze. K. Norton. *Gas World*, August 30, 165. A graphic method for estimating calorific value from volatile matter and ash is described.

FUEL. Coal economy in metallurgy. *Engineering*, August 29, 279-280. Editorial, indicating lines on which economy may be effected.

FUNGICIDES. The chemistry of Burgundy mixtures. R. L. Mond and C. Heberlein. *J. Chem. Soc.*, August, 908-922. Deals with the mixtures of copper sulphate and sodium carbonate used as fungicides.

GAS. Steaming in horizontal retorts. N. Humphrys. *Gas World*, August 30, 164. Remarks on P. B. Ellacott's paper (CHEMICAL AGE, p. 310).

JAPAN. Japanese chemical industries and protection. *Board of Trade J.*, August 28, 268. Resolutions presented to the Japanese Government calling for protection.

PHOSPHATE. The phosphate industry in Tunis. *Board of Trade J.*, August 28, 277-278. Statistics for 1918, showing the effect of the war.

PLANT. The failure of two autoclaves. *Engineering*, August 29, 289-290.

WOOD. The rapid seasoning of Jarrah. A. Tomlinson. *Engineering*, August 29, 287-289. An account of the successful rapid seasoning treatment of Australian wood.

American

CALORIMETERS. Some points regarding calorimeter efficiency. W. P. White. *Chem. and Met. Eng.*, August 15, 187-190. A discussion of different types of calorimeter, sources of error, &c.

An adiabatic calorimeter. E. B. Holland, J. C. Reed, and J. P. Buckley. *Chem. and Met. Eng.*, August 15, 190-191. Describes an improved jacket arrangement and stirrer for the Berthelot-Mahler-Kroecker calorimeter.

COKING. Experimental retort tests of Orient coal. R. S. McBride and I. V. Brumbaugh. *Chem. and Met. Eng.*, August 15, 171-174. Tests on coal from the Orient Mine, Illinois, show clearly the influence of temperature on the quality of coke and the quality and quantity of the gas produced.

GRAPHITE. Structure of graphite in relationship to crucible making. R. Thiessen. *J. Amer. Ceram. Soc.*, July, 508-542. Microscopical examination throws much light on this subject.

MANGANESE. Uses of manganese dioxide ore. W. C. Phalen. *Chem. and Met. Eng.*, August 15, 196-199. The uses of manganese compounds in dry cells and ceramics and as driers is discussed.

PORCELAIN. Japanese porcelains from the chemical point of view, and how to improve them. Y. Kitamura. *Chem. and Met. Eng.*, August 15, 183-185. Abstracted from *The Chemical Technology* (Japan).

PRICES. Prices of chemicals during the war. F. E. Breithut. *Chem. and Met. Eng.*, August 15, 174-176. Interesting charts showing the great fluctuations which have occurred.

SHALE. Oil shales. L. Simpson. *Chem. and Met. Eng.*, August 15, 176-178. A *résumé* of methods of retorting, with notes in regard to the best practice.

STEEL. Notes on the heat treatment of steel. T. D. Lynch. *Proc. Eng. Soc. W. Penna.*, June, 215-242. A general treatment of the subject, with special reference to shells.

WOOD DISTILLATION. New method of distilling both green and seasoned hardwoods. *Chem. and Met. Eng.*, August 15, 193-194. A method of making and distilling briquettes of sawdust or other wood waste is described.

ZINC. Notes on the estimation of metallic zinc content of zinc dust. W. F. Edwards. *Chem. and Met. Eng.*, August 15, 192. Various methods are compared.

French

FILTRATION. Progress of industrial filtration. L. Fabre. *Chem. et Ind.*, July, 759-769. A number of modern plants are described and illustrated.

SHALES. The testing of shales. P. Nicolardot and H. Baurier. *Chem. et Ind.*, July, 770-777. Methods of testing have been devised to give results approximating to industrial yields of oil, &c.

German

EVAPORATORS. Plant for evaporation under pressure. J. Pokorny. *Zeits. Zucherind. Böhmen*, May, 307-405. An illustrated article dealing more particularly with plant for the sugar industry.

Miscellaneous

EXPLOSIVES. High explosives. B. Oddo. *Annali Chim. Applic.*, Nos. 9-12, 165-168. A general account of high explosives now and formerly in use.

POTASH. Sea water and the problem of potash salts. E. Manzella. *Annali Chim. Applic.*, Nos. 9-12, 145-156.

Protection of Japan's Chemical Industry

THE *Board of Trade Journal* announce that the following resolutions, calling for protection, have been passed by a Committee of the Japan Chemical Industries' Association, and communicated to the Japanese Government:—

1. An import duty of yen 5 per 100 kin to be imposed on potassium chlorate, provided no duty is imposed on potassium chloride.

2. Import duty on caustic soda to be 25 per cent. Price of salt to be reduced to 40 sen. Exports of bleaching powder to be subsidised at the rate of yen 1 per 100 lb.

3. The post-war cost of the manufacture of soda ash may be estimated as yen 115.77 (? per ton), and it is requested that the Government take steps to protect the industry, as prospects are not entirely hopeless.

4. The present import duty of 5 per cent. on "intermediate" chemical manufactures (*i.e.*, those which are neither dyestuffs nor drugs), should be revised.

A duty of 25 per cent. *ad valorem* to be imposed on raw materials such as benzine and methyl alcohol; on salvarsan and compounds of arsenic, yen 4 per gram.

5. That the Government-protected factories should not take up the manufacture of products successfully manufactured by private concerns.

6. The Government should establish regulations for granting subsidies to exporters of chemicals, and arrange for rebates of insurance and freight charges.

7. If import duties on zinc and lead be increased at any time in the future, a rebate should be given when these materials are to be used for the manufacture of paint or cosmetics.

Patent Literature

We publish each week a list of selected complete specifications accepted as and when they are actually printed and on sale. In addition, we give abstracts within a week of the specifications being obtainable. Readers can thus decide what specifications are of sufficient interest to warrant purchase, the only way of obtaining complete information. Lists of patent applications and of "convention" specifications open to inspection before acceptance are added; abstracts of the latter appear as soon as possible thereafter.

Abstracts of Complete Specifications

29,628 of 1913. Reducing Agents and process for manufacturing same. P. Goldstein, 4, Stromstrasse, Berlin. International Convention date (Germany), December 23, 1912.

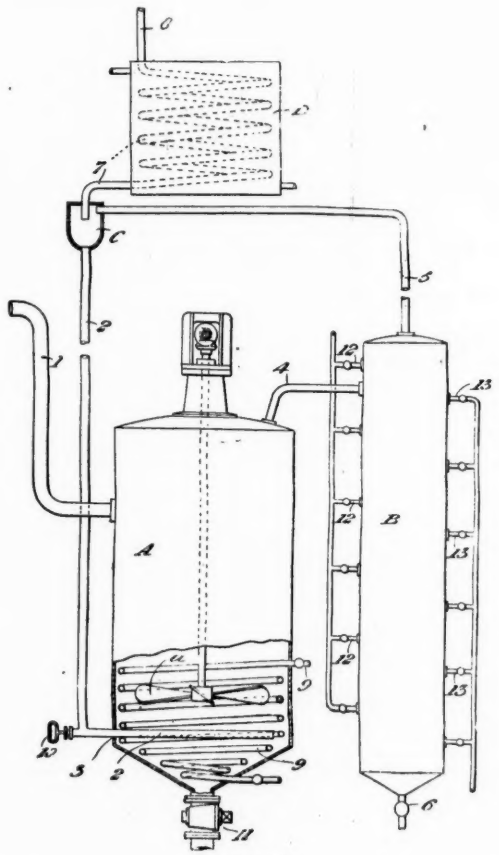
Metallic reducing agents, such as sodium, calcium or magnesium, which are easly oxidisable, are mixed with metal chips and compressed into briquettes. Metallic oxides which are to be reduced may be mixed with the metal chips and incorporated into the briquettes.

115,236. Colloidal Solutions, Manufacture of. J. Müller, 34, Hildesheimerstrasse, Hanover, Germany. International Convention date (Germany), March 3, 1917.

The solid substance is finely comminuted and then mixed with an aqueous solution of cherry gum to convert it into a colloidal solution. Solid substances which may be so treated comprise sulphur, selenium, tellurium, carbon, silicon, titanium, nickel and other metals, sulphates of barium or lead, white lead, oxides of iron or chromium, and metal sulphides.

130,358. Hydrogen, Manufacture of Compressed. L'Air Liquide, Soc. Anon. pour l'Etude et l'Exploitation des Procédés G. Claude, 48, Rue St. Lazare, Paris. International Convention date (France), August 9, 1917.

Hydrogen contained in gas mixtures such as water gas, coal gas, coke oven gas, &c., is extracted by dissolving the other gases in ether, methyl acetate, or other liquid having a similar solvent action on carbon monoxide, a similar ratio of solubilities of carbon monoxide and hydrogen, and a similar temperature coefficient of this ratio. The gas is treated at a pressure of 50-300 atmospheres and a temperature of —40° to —60° C. Loss of the solvent vapour is avoided by liberating the dissolved gases at a pressure of 10 to 50 atmospheres and at a low temperature. The ratio of solubility of carbon monoxide to hydrogen under these conditions is about 5, so that the greater part of the hydrogen remains undissolved.



130,362

130,362. Tar, Separation of Oils and Pitch from. Dr. R. Lessing, Southampton House, 317, High Holborn, London. Application date, January 28, 1918.

Tar which has been freed from ammoniacal liquor, benzol and naphtha is fed into the vessel A by the pipe 1. A solvent such as petroleum spirit, boiling at 100°–120° C., enters by the pipe 2, which is perforated within the vessel to distribute the solvent. The solvent in passing upward through the tar forms an oil solution which overflows by the pipe 4 into the still B, which may be a column heated by steam, which enters by the pipes 12 and leaves by the pipes 13. The oil in trickling down the still is freed from the solvent, which is vaporised, and escapes by the pipe 5 to the vessel C and condenser D. The condensate is returned by the pipe 2 to the vessel A. The oily residue is withdrawn at the outlet 6. The temperature in the vessel A is kept just below the boiling point of the solvent by means of the steam coils 9, and a stirring device *a* is provided. The pitch is run off through the valve 11. The tar oils may be treated before distillation with caustic soda and then with an acid to remove phenols and pyridine.

130,365. Ammonia, Conversion of Synthetic—into a solid product applicable for Agricultural Purposes in conjunction with the production of Carbonate of Soda. L'Air Liquide, Soc. Anon. pour l'Etude et l'Exploitation des Procédés G. Claude, 48, Rue St. Lazare, Paris. International Convention date (France), August 25, 1917.

Water gas is made under conditions which produce a mixture of carbon dioxide and monoxide as well as the hydrogen necessary for the synthesis of ammonia. The ammoniacal solution is mixed with sea salt, and carbon dioxide obtained as above is passed through it under pressure so as to produce sodium bicarbonate which is partly precipitated, and ammonium chloride which remains in solution. After concentrating the solution, it is neutralised with sulphuric or hydrochloric acid, and the ammonium chloride crystallised out. The bicarbonate is heated to convert it into normal carbonate, and the carbon dioxide liberated is used over again.

130,381. Aluminium Alloys. W. A. Naish, 24, University Mansions, Putney, London, S.W. Application date, August 6, 1918.

An aluminium alloy which requires no after heat-treatment consists of 0.75 to 1.5 per cent. of copper, 6 to 12 per cent. of zinc, 0.25 to 0.75 per cent. of magnesium, 0.5 to 2.0 per cent. of iron, 0.5 to 1.5 per cent. of silicon, and the remainder of aluminium.

130,383. Gases, Material for Removing Carbon Monoxide from. South Metropolitan Gas Company and J. M. Somerville, 709, Old Kent Road, London. Application date, February 7, 1918.

Commercial caustic soda is heated to a temperature of about 700° F., and asbestos wool in the proportion of 8 parts to 22 parts then added. The mixture is allowed to solidify, and is then granulated. The material is only slightly deliquesent, and is capable of readily removing carbon monoxide from gases—*e.g.*, water gas, when heated to about 680° to 700° F.

130,402. Cellulose Acetate Solutions. Cellon Ltd., Broad Street House, New Broad Street, London, E.C. 2; T. Tyrer & Co., Ltd., Abbey Lane, Stratford, London, E. 15,

and T. Tyrer, 14, Sandwell Mansions, London, N.W. 6. Application date, February 15, 1918.

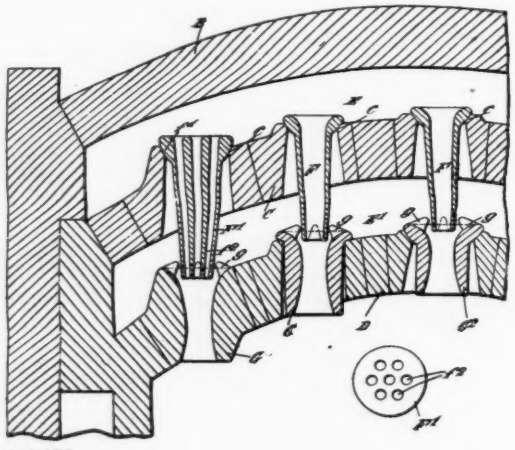
In the manufacture of solutions of cellulose acetate, such solvents as benzyl alcohol, tolyl carbinol, &c., are replaced by cyclohexanone or other cyclo ketones.

130,455. Fuels, Treatment of Certain—to Improve their Calorific Value. Prof. W. A. Bone, Imperial College of Science and Technology, London, S.W. 7. Application date, July 30, 1918.

Brown coals or lignites are dried and heated by boiler flue gases containing 10–12.5 per cent. of carbon dioxide to about 375° C.—*i.e.*, just short of the temperature at which oils commence to distil. Water and a small quantity of carbon dioxide are liberated by chemical change above 250° C., while gases containing more than 10 per cent. of carbon dioxide are substantially inert to the fuel. The calorific value of Morwell brown coal was raised from 5,855 B.T.U. per lb. to 10,060 B.T.U. per lb. by this process.

130,475. Gas Fired Furnaces. Smeeton-Wright Furnaces Ltd., J. E. Fletcher, and T. Wright, 56, Victoria Street, Westminster. Application date, August 1, 1918.

A gas-fired furnace is provided with an arched cover B, and with intermediate and bottom arches C, D, enclosing the air and



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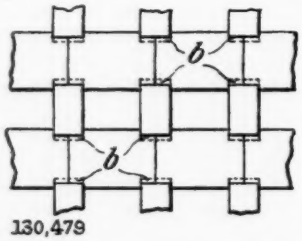
gas spaces E, E¹. Burner nozzles F or F¹ are provided with spherical bearing surfaces f^1 so as to be adjustable angularly, and their outlet ends are arranged adjacent to or projecting into the lower or mixing nozzles G. Guiding lugs *g* are provided on the latter so that the nozzles F or F¹ are maintained substantially central. The nozzles G may also be provided with spherical bearing surfaces, as shown at G², so as to be self-adjusting. The gas nozzles may be provided with a number of axial passages as shown at f^2.

130,479. Regenerator Chambers of Furnaces or the Like, Chequer Bricks for. T. Williams, Gwalia, The Cliff, Seaton Carew, Durham, and South Durham Steel and Iron Co., Ltd., Stockton-on-Tees. Application date, August 9, 1918.

The bricks for use in building up the regenerating chambers of furnaces are provided with recesses at the ends extending across



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the upper and lower faces of the brick. When laid end to end a number of transverse grooves are formed so that when the rows of transverse bricks are laid on them the notches or recesses interlock. The bricks are thus prevented from being dislodged due to creeping or explosions in the flues.

130,483. Zinc Melting Apparatus. T. Aramaki, 18, Koun-Cho, Mita, Shiba-Ku, Tokyo, Japan. Application date, August 14, 1918.

An outer tank is provided with a bottomless internal sleeve provided with flanges, which rest on the tank rim. The sleeve is rounded at the corners so as to provide an enlargement of the annular space to facilitate inspection. The bottom of the tank contains a layer of molten lead upon which the molten zinc in the inner space floats. The sleeve is renewable without cooling the molten metal.

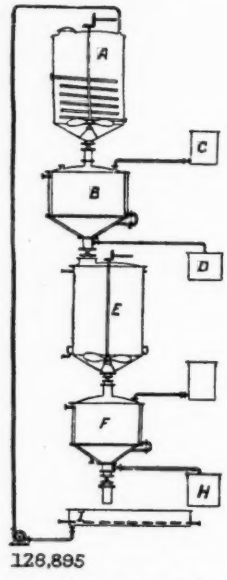
130,528. Indiarubber Compositions or Substitutes therefor. W. F. Macdonald, 53, Palace Court, Bayswater, London, W. 2. Application date, November 21, 1918.

A material suitable for jointing, tyres, mats, &c., is made by using powdered slate as a filling in vulcanised indiarubber. As an example 50 per cent. of powdered slate, 15 per cent. of sulphur, and 35 per cent. of indiarubber may be used.

International Convention Specifications Open to Inspection

128,895. Ammonium and Sodium Sulphates. Soc. Industrielle de Produits Chimiques, 10, Rue de Vienne, Paris. International Convention date, June 22, 1918. (Addition to 127,549.)

A charge of the double sulphate of ammonium and sodium, together with water and a small quantity of ammonium sulphate, is heated by a steam coil and agitated in the vessel A. At a temperature of 110°—111° C. the mixture is passed into the steam heated filter B, where sodium sulphate is separated out. The



128,895

filtrate passes into the vessel E, where it is cooled to 62° C., and ammonium sulphate and a small quantity of sodium sulphate are crystallised. The crystals are separated by the filter F. The filtrate is concentrated in the vessel I, and then returned to the vessel A together with a fresh charge of the double sulphate and a small quantity of sodium sulphate. The sodium sulphate in the filter B is washed with a hot saturated solution of the same salt from the vessel C, the washing liquid passing either to the vessel E or vessel D. The ammonium sulphate in the filter F is similarly treated with a saturated solution of the salt at 60° C. The double sulphate is prepared by the action of ammonia on sodium bisulphate.

128,915-6-7. Motor Spirit. U.S. Industrial Alcohol Co., 27, William Street, New York. International Convention date, June 25, 1918.

128,915. The motor spirit consists of petroleum distillate such as gasolene or naphtha, ether such as ethyl or butyl ether, alcohol

such as ethyl, methyl or butyl alcohol, and an aromatic hydrocarbon such as benzol or toluol.

128,916. As in 128,915, with the omission of the petroleum distillate.

128,917. As in 128,915 with the omission of the ether.

128,929. Alcohol. Compagnie des Produits Chimiques d'Alais et de la Camargue, 126, Rue de la Boëtie, Paris. International Convention date, February 26, 1918.

Alcohol is produced by the catalytic hydrogenation of acetaldehyde vapour under pressure. The gases may be cooled by expansion on leaving the catalyst tube.

128,930. Ammonia; Cyanogen Compounds. Nitrogen Corporation, 55, Canal Street, Providence, R.I., U.S.A. International Convention date, June 25, 1918.

Ammonia is produced synthetically at low temperatures and under pressure just sufficient to prevent dissociation of the catalyst, which may be cyanamide of calcium, barium, strontium, copper or silver, nitride of copper or silver, or paracyanogen. Processes are given for preparing each of the catalysts in suitable form.

128,945. Filtering Liquids. J. Y. Conte, 36, Calle de Bailen, Barcelona, Spain. International Convention date, June 27, 1918.

The liquid to be filtered is sprayed from a horizontal row of nozzles on to the external cylindrical filtering surface of a rotary drum. The drum is divided into compartments by radial partitions which communicate with two independent suction conduits close to the axis of rotation of the drum. A scraper is provided to remove separated solid matter from the rotating drum, and the compartment which is momentarily between the sprayer and the scraper is connected to the conduit through which the suction is weaker.

Latest Notifications.

131,588. Coal, Treatment of—to obtain bituminous constituents. Rutgerswerke Akt. Ges. August 9, 1918.

131,600. Ethylacetate from paraldehyde as the primary material, Manufacture of. Soc. des Acieries et Forges de Firminy. March 13, 1918.

Specifications Accepted, with Date of Application

130,626. Metal Chlorides, Manufacture of. W. Heap and E. Newbery. January 29, 1918.

130,654. Gases, Removal of sulphur and sulphur-containing bodies from. E. K. Rideal and H. S. Taylor. March 2, 1918.

130,680. Material with gas or vapour, Apparatus for treating. F. L. Slocum. March 13, 1918.

130,693. Nitrogen of the atmosphere, Fixation of. R. Pearson and H. C. Parkes. March 15, 1918.

130,699. Fuel oils. F. Tinker. March 18, 1918.

130,703. Electric-arc furnaces. British Thomson-Houston Co. and J. J. Ash. March 19, 1918.

130,712. Sulphuric acid, Production of. K. B. Quinan. May 17, 1918.

130,754. Suction-gas producers. L. Barrow, S. M. Scott, and Cadbury Bros. August 6, 1918.

130,755. Drying powdered material. A. C. Ionides. August 6, 1918.

130,796. Gas manufacture. R. M. Simpson and G. R. Hislop. August 17, 1918.

130,816. Electric-arc furnaces. J. Bilby. September 2, 1918.

130,844. Sodium permanganate, Manufacture of. D. Tyrer. October 9, 1918.

122,402. Artificial fuel. R. F. Dalton. January 12, 1918.

130,912. Furnaces. C. Zulver and L. E. Smith. February 24, 1919.

The first claim for compensation in South Wales, made by a workman who contracted silicosis while working at a silica works, was heard at Swansea. A workman from the Morriston Silica Works had been suspended from work as a sufferer from silicosis by the appointed medical officer. It was agreed to grant full pay for two weeks and £1 5s. a week for the remaining weeks of three months.

The Phosphate Industry of Tunis

In 1913 the total value of the production of the Tunisian mines amounted to 65,500,000 francs, as follows:—

	Tons.	Francs.
Phosphates	2,072,000	45,500,000
Lead Ore	59,500	9,500,000
Zinc Ore	28,600	3,000,000
Iron Ore	594,200	7,500,000

The corresponding approximate value of mineral ore and phosphates transported by the Tunisian railways during 1918 was as follows:—

	Tons.	Value in Francs.
Phosphates	862,494	25,874,820
Lead Ore	30,662	13,031,350
Lead Pure..	301	361,200
Zinc Ore	5,508	1,046,520
Iron Ore	445,022	12,238,105
Manganese Ore	830	49,800
Liquites	41,555	2,493,300

Tunis comes second to the United States as regards the production of phosphates. Exploitation began in 1899, and in 1913 the production was over 2,000,000 tons. Tunisian phosphates can be classed under two categories: 58-63 and 63-68 per cent. of phosphate tricalcite with less than 2 per cent. iron and alumina combined. The activity of the phosphate mines was greatly restricted during the war by lack of labour, high wages, lack of fuel and raw materials necessary for working and for the upkeep of underground galleries, new material, plant, &c. The requirements of sulphuric acid for war purposes increased gradually to the detriment of those factories manufacturing superphosphates. Together with this, the shortage of tonnage greatly impeded the supplies of those factories as regards phosphates and pyrites. The demand of agriculture, although reduced, has only been partially supplied, and that after considerable delay owing to the congestion on the railways. Moreover, the prices of super-phosphates have been affected like those of most other commodities by a great increase, 30 francs per 100 kilos instead of 5 to 6 francs before the war.

The following table shows the quantities of phosphates exported from Tunis according to countries in 1913 and in 1918.

	1913	1914	1917 (1st half-year)	1918
	Tons.	Tons.	Tons.	Tons.
United Kingdom	181,305	193,397	204,645	219,343
France	698,529	399,529	142,281	80,767
Italy	453,183	412,810	225,908	72,344
Portugal	40,404	36,508	12,730	—
Spain	52,985	49,295	16,315	4,960
Denmark	12,437	7,025	10,562	—
Other Countries	546,037	328,597	—	290
Total ..	1,984,880	1,427,161	612,441	377,704

As regards the direction of the exports, it will be seen that there were no exports to enemy countries. Belgium, Russia, Roumania and Japan. Exports to neutral countries, after a slight decline in 1914-15, reached the figure of 189,000 tons in 1916, which is greater than that of 1913 (177,000 tons), on account of the greatly increased demand of Denmark (37,000 tons in 1915 and 77,000 in 1916, as against 12,000 tons only in 1913). On account of the measures taken to limit the tonnage to destinations which might appear doubtful, the exports to neutral countries fell to 27,000 tons in 1917 and 5,250 tons during the first half-year of 1918. Before the war, the two greatest consumers of Tunisian phosphates were France and Italy. As regard France, exports fell from 700,000 tons in 1913 to 142,000 tons in 1917. The first half of 1918 seems to show a slight increase with 81,000 tons. As regards Italy, the decrease was less acute—450,000 tons in 1913 and 205,000 tons in 1917—and the first half-year of 1918 shows a very great decrease to 72,000 tons. The United Kingdom, on the other hand, increased her demands from 181,000 tons in 1913 to 205,000 tons in 1917, and the first half of 1918 shows a considerable increase to 219,000 tons. This result is due to the fact that the United Kingdom before the war imported great quantities of phosphates from Florida, and that for the moment she could only get her supplies from North Africa. It is, moreover, evident that after this war the British market will be more open to African phosphates than it was before 1913.

Market Report and Current Prices

Our Market Report and Current Prices are exclusive to THE CHEMICAL AGE, *and, being independently prepared with absolute impartiality by Messrs. R. W. Greeff & Co. and Messrs. Chas. Page & Co., Ltd., may be accepted as authoritative. The prices given apply to fair quantities delivered ex wharf or works, except where otherwise stated. The weekly report contains only commodities whose values are at the time of particular interest or of a fluctuating nature. A more complete report and list are published once a month. The current prices are given mainly as a guide to works managers, chemists, and chemical engineers; those interested in close variations in prices should study the market report.*

Market Report

THURSDAY, September 4, 1919.

BUSINESS on the whole has been fair and enquiries are coming in better. Prices are without much variation, and there is a very firm undertone for most products.

Export has been active and much more business could be done if the present vexatious congestion at the main ports was overcome, thus enabling quicker shipments to be effected.

Owing mainly to the exchange position this country is now able to export to America several chemicals which only a few months ago were being imported from that country.

It is too early yet to attempt to estimate what will be the effect of the removal of import restriction on the chemical markets for those products which are not protected under the heading of "Key Industries."

General Chemicals

ACETONE.—The position remains unaltered.

ACID ACETIC.—Shipments from America are arriving very slowly, and existing stocks are being rapidly cleared. Prices have hardened in consequence.

ACID CARBOLIC.—Makers find themselves compelled to raise prices again. The heavy demand for export still continues.

ACID OXALIC.—A fair business is being done at full prices.

ACID TARTARIC.—All the works are busily occupied, and slightly higher prices are being quoted. Large shipments are taking place.

AMMONIUM SALTS are active. Heavy orders are being received for Salammoniac, which makers are unable to fill for early delivery. Trade is better in Carbonate and Liquor.

ARSENIC.—The market is much firmer, and higher prices are expected.

BLEACHING POWDER.—Slightly better trade is reported on export account.

BORAX.—Only limited quantities can be obtained for export, and some large business has been transacted at a substantial premium on current prices.

COPPER SULPHATE.—There are a few inquiries in the market, but we cannot trace any important business having been concluded for forward delivery.

CREAM TARTAR.—The raw material being again dearer, the makers are holding out for higher prices.

FORMALDEHYDE.—In consequence of the much firmer position of methyl alcohol the price of formaldehyde has been raised slightly. There is every prospect of a further advance.

LEAD ACETATE.—Price is well maintained for white. Brown if anything a shade easier.

LITHOPONE.—In spite of the large shipments which are arriving there appears to be difficulty in satisfying buyers' requirements.

METHYL ALCOHOL.—Buyers are recommended to cover their requirements whilst supplies can be obtained.

POTASH BICHROMATE.—Important export inquiries are being received, and we would not be surprised to see higher prices rule again before long.

POTASSIUM PRUSSIATE is dull, and the recent improvement seems to have fallen off.

SODIUM ACETATE.—Price well maintained and better business reported.

SODIUM BISULPHITE.—Some heavy orders have been booked on export account, and makers are fully sold for some weeks ahead.

SODIUM BICHROMATE.—In steady request. The American parity is now over that of the English price.

SODIUM CAUSTIC.—Prices have been ruling steady, and business for export is improving.

SODIUM NITRITE.—Business is quiet and on a hand to mouth basis.

SODIUM PRUSSIATE is firmer, and some large orders have been booked on export account.

SODIUM SULPHIDE is slow of sale, although the recent coal strike has restricted output.

Heavy Coal Tar Products

The markets generally are firmer and a greater amount of business is being done.

There is little disposition on the part of manufacturers to sell for deliveries beyond December of this year.

BENZOL.—There is no change in the home trade prices, but for export 1s. 11½d., f.o.b., is now asked.

CREOSOTE is in fair demand at recent prices: 5¾d. to 6d. per gallon in the South, and 5d. to 5½d. per gallon in the North.

CRESYLIC ACID.—There is an improved demand, but business is limited owing to the pretensions of manufacturers in respect of price, especially for the better qualities. Pale, 97 per cent., is to-day quoted 2s. 6d. per gallon, and dark 2s. 3d. to 2s. 4d. per gallon at the works.

NAPHTHALENE.—£6 8s. per ton for crude, and £16 18s. per ton for refined.

PITCH.—75s. has been paid f.o.b. East Coast, 72s. 6d. f.o.b. South Coast, while 65s. is asked for the West Coast.

SOLVENT NAPHTHA.—The demand is good, and business is being done at 2s. 3d. to 2s. 4d. in London; 2s. to 2s. 1d. in the North.

Sulphate of Ammonia

There is no change in the position, and there appears to be no immediate prospect of export being allowed.

The home trade prices for next year have been fixed at £20—£22 per ton, according to date of delivery.

Current Prices

Chemicals

September 4, 1919.

	per	£	s.	d.		£	s.	d.
Acetic anhydride	lb.	0	2	9	to	0	3	0
Acetone, pure	ton	95	0	0	to	97	0	0
Acid, Acetic, glacial, 99-100%	ton	82	10	0	to	84	0	0
Acetic, 80% pure	ton	65	0	0	to	67	10	0
Carbolic, cryst. 39-40°	lb.	0	0	9½	to	0	0	10
Citric	lb.	0	4	4	to	0	4	5
Lactic, 50 vol.	ton	66	0	0	to	68	0	0
Lactic, 60 vol.	ton	83	10	0	to	85	0	0
Oxalic	lb.	0	1	2½	to	0	1	3
Pyrogallic, cryst.	lb.	0	11	6	to	0	11	9
Tannic, commercial	lb.	0	2	9	to	0	3	0
Tartaric	lb.	0	3	2	to	0	3	3
Alum, lump	ton	17	10	0	to	17	15	0
Aluminium, sulphate, 14-15%	ton	13	10	0	to	14	0	0
Aluminium, sulphate, 17-18%	ton	17	0	0	to	17	10	0
Ammonia, anhydrous	lb.	0	1	8	to	0	1	9
Ammonia, .880	ton	32	10	0	to	35	0	0
Ammonia, carbonate	lb.	0	0	6½	to		—	
Ammonia, muriate (galvanisers)	ton	45	0	0	to	46	0	0
Ammonia, nitrate	ton	55	0	0	to	57	10	0
Ammonia, phosphate	ton	112	0	0	to	115	0	0
Arsenic, white, powdered	ton	55	0	0	to	57	0	0
Barium, carbonate, 92-94%	ton	12	0	0	to	13	0	0
Chloride	ton	25	10	0	to	26	0	0
Nitrate	ton	50	0	0	to	51	0	0
Sulphate, blanc fixe, dry	ton	25	10	0	to	26	0	0
Sulphate blanc fixe, pulp	ton	15	10	0	to	16	0	0
Bleaching powder, 35-37%	ton	13	0	0	to	13	10	0
Borax crystals	ton	39	0	0	to	40	0	0

	per	£	s.	d.		£	s.	d.
Calcium acetate, grey	ton	21	10	0	to	22	10	0
Chloride	ton	8	10	0	to	9	0	0
Casein, technical	ton	78	0	0	to	80	0	0
Cobalt oxide, black	lb.	0	7	9	to	0	8	0
Copper sulphate	ton	44	0	0	to	45	0	0
Cream Tartar, 98-100%	ton	245	0	0	to	250	0	0
Epsom Salts (see Magnesium Sulphate).								
Iron perchloride	ton	32	0	0	to	34	0	0
Iron sulphate (Copperas)	ton	4	15	0	to	4	17	6
Lead acetate, white	ton	82	10	0	to	85	0	0
Carbonate (White Lead)	ton	51	0	0	to	55	0	0
Nitrate	ton	58	0	0	to	59	0	0
Lithophone, 30%	ton	44	0	0	to	45	0	0
Magnesium chloride	ton	15	0	0	to	16	0	0
Carbonate, light	cwt.	3	0	0	to	3	5	0
Sulphate (Epsom salts commercial)	ton	11	10	0	to	12	10	0
Sulphate (Druggists')	ton	17	0	0	to	18	0	0
Methyl acetone	ton	89	0	0	to	90	0	0
Alcohol, 1% acetone	gall.	0	11	0	to	0	11	6
Potassium bichromate	lb.	0	1	6	to	0	1	7
Carbonate, 90%	ton	93	0	0	to	95	0	0
Chlorate	lb.	0	1	2	to	0	1	3
Meta-bisulphite, 50-52%	ton	210	0	0	to	220	0	0
Nitrate refined	ton	58	0	0	to	60	0	0
Permanganate	lb.	0	3	3	to	0	3	6
Prussiate, yellow	lb.	0	1	10	to	0	1	11
Prussiate red	lb.	0	6	0	to	0	6	3
Sulphate	ton	37	10	0	to	40	0	0
Salammoniac, firsts	cwt.	4	0	0				
Seconds	cwt.	3	15	0				
Sodium acetate	ton	53	0	0	to	55	0	0
Arsenate, 45%	ton	47	10	0	to	48	10	0
Bicarbonate	ton	9	0	0	to	9	10	0
Bisulphite, 60-62%	ton	31	0	0	to	32	0	0
Chlorate	lb.	0	0	7	to	0	0	7½
Caustic, 70%	ton	20	10	0	to	21	0	0
Caustic, 76%	ton	23	0	0	to	24	0	0
Hyposulphite, commercial	ton	18	10	0	to	19	0	0
Nitrite, 96-98%	ton	57	0	0	to	59	0	0
Phosphate, crystal	ton	25	0	0	to	25	10	0
Prussiate	lb.	0	0	7½	to	0	0	8
Sulphide, crystals	ton	15	10	0	to	16	0	0
Sulphide, solid, 60-62%	ton	22	0	0	to	22	10	0
Sulphite, crys+.	ton	11	0	0	to	11	10	0
Strontium carbonate	ton	85	0	0	to	90	0	0
„ Sulphate, white	ton	8	10	0	to	10	0	0
Sulphur chloride	ton	38	0	0	to	40	0	0
Tetrachlorethane (Westron)	ton	60	0	0	to	65	0	0
Tin perchloride, 33%	lb.	0	2	4	to	0	2	5
„ Protochloride (tin crystals)	lb.	0	1	9	to	0	1	10
Trichlorethylene (Westrosol)	ton	75	0	0	to	80	0	0
Zinc chloride 102 Tw.	ton	22	0	0	to	23	0	0
Chloride, solid, 96-98%	ton	60	0	0	to	62	10	0
Sulphate	ton	21	10	0	to	23	0	0
Oxide, Redseal	ton	75	0	0	to	80	0	0

Coal Tar Intermediates, &c.

Alphanaphthol, crude	lb.	0	3	0	to	0	3	6
Alphanaphthol, refined	lb.	0	3	6	to	0	3	9
Alphanaphthylamine	lb.	0	2	6	to	0	2	9
Aniline oil, drums free	lb.	0	1	3	to	0	1	4
Aniline salts	lb.	0	1	3½	to	0	1	4
Anthracene, 85-90%	lb.	0	1	5	to	0	1	6
Benzaldehyde (free of chlorine)	lb.	0	3	6	to	0	3	9
Benzidine, base	lb.	0	5	6	to	0	6	0
Benzidine, sulphate	lb.	0	4	9	to	0	5	0
Benzoic, acid	lb.	0	5	0	to	0	5	3
Benzoate of soda	lb.	0	5	0	to	0	5	3
Benzyl chloride, technical	lb.	0	1	9	to	0	2	0
Betanaphthol benzoate	lb.	1	6	0	to	1	7	6
Betanaphthol	lb.	0	2	3	to	0	2	6
Betanaphthylamine, technical	lb.	0	6	6	to	0	7	0
Dichlorbenzol	lb.	0	0	5	to	0	0	6
Diethylaniline	lb.	0	7	0	to	0	8	0
Dinitrobenzol	lb.	0	1	4	to	0	1	6
Dinitrochlorbenzol	lb.	0	1	2	to	0	1	3
Dinitronaphthaline	lb.	0	2	0	to	0	2	3
Dinitrotoluol	lb.	0	1	10	to	0	2	0
Dinitrophenol	lb.	0	1	10	to	0	2	
Dimethylaniline	lb.	0	2	9	to	0	3	0
Diphenylamine	lb.	0	3	0	to	0	3	3
H-Acid	lb.	0	7	6	to	0	8	0
Metaphenylenediamine	lb.	0	4	6	to	0	4	9
Monochlorbenzol	lb.	0	0	9	to	0	0	10
Naphthionic acid, crude	lb.	0	3	6	to	0	3	9
Naphthylamin-di-sulphonic acid	lb.	0	4	6	to	0	5	0
Nitronaphthaline	lb.	0	1	2	to	0	1	6

	per	£	s.	d.		£	s.	d.
Nitrotoluol	lb.	0	1	3	to	0	1	6
Orthoamidophenol	lb.	0	18	0	to	1	0	0
Orthodichlorbenzol	lb.	0	1	1	to	0	1	3
Orthotoluidine	lb.	0	2	0	to	0	2	3
Orthonitrotoluol	lb.	0	1	6	to	0	1	9
Para-amidophenol, base	lb.	0	14	0	to	0	15	0
Para-amidophenol, hydrochlor.	lb.	0	15	6	to	0	16	0
Paradichlorbenzol	lb.	0	0	4	to	0	0	5
Paranitraniline	lb.	0	4	0	to	0	4	6
Paranitrotoluol	lb.	0	5	3	to	0	5	6
Paraphenylenediamine, distilled	lb.	0	14	0	to	0	15	0
Paratoluidine	lb.	0	7	0	to	0	7	6
Phthalic anhydride	lb.	0	6	0	to	0	7	6
Resorcin, technical	lb.	0	11	0	to	0	12	0
Resorcin, pure	lb.	0	17	6	to	1	0	0
Salicylic acid	lb.	0	2	0	to	0	2	8
Salol	lb.	0	4	9	to	0	5	0
Sulphanilic acid, crude	lb.	0	1	2	to	0	1	3
Tolidine, base	lb.	0	9	0	to	0	10	0
Tolidine, mixture	lb.	0	2	9	to	0	3	0

Miscellaneous and Paint Materials

Barytes	ton	11	0	0	to	13	0	0
Casein	ton	75	0	0	to	80	0	0
Chalk, precipated (light)	ton	20	0	0	to	24	0	0
Chalk, precipated (heavy)	ton	10	0	0	to	12	0	0
China clay (bags extra) (f.o.r. Cornwall)	ton	1	12	6	to	3	12	6
Coke (blast furnace)	ton	3	15	0	to	4	0	0
Coke (foundry)	ton	3	15	0	to	4	5	0
Fuller's Earth	ton	4	0	0	to	5	0	0
Lead, litharge flake	ton	43	10	0	to	45	10	0
Lead, red	cwt.	2	2	6	to	2	7	6
Lead, white	cwt.	2	10	0	to	2	15	0
Ultramarine	ton	85	0	0	to	105	0	0
Prussian Blue	cwt.	11	0	0	to	11	10	0
Chrome green	cwt.	6	5	0	to	6	10	0
Chrome yellow	cwt.	6	5	0	to	7	0	0
Mineral black	ton	8	0	0	to	10	0	0
Carbon black	lb.	0	1	3	to	0	1	6
Cuignet's Green, 30%	lb.	0	1	5	to	0	1	6

The following prices are furnished by Messrs. Miles Mole & Co. Ltd., 101, Leadenhall Street, London, E.C.

Metals and Ferro-Alloys

Aluminium, 98-99%	ton	150	0	0	to	159	0	0
Antimony (English)	ton	44	0	0	to	44	0	0
Copper, best selected	ton	108	0	0	to	109	0	0
Ferro-chrome, 60%	ton	55	0	0	to	56	0	0
Ferro-manganese, 76-80%	ton	25	0	0	to	25	10	0
Ferro-silicon, 45-50%	ton	21	0	0	to	21	10	0
Ferro-tungsten, 75-80%	lb.	0	2	10	to	0	3	0
Lead (ingot)	ton	26	0	0	to	26	5	0
Lead (sheets)	ton	37	0	0	to	38	0	0
Nickel, 98-99%	ton	205	0	0	to	205	5	0
Tin	ton	272	0	0	to	274	0	0
Zinc (spelter)	ton	44	0	0	to	44	10	0

Structural Steel

Angles, tees and flats	ton	18	5	0	to	20	15	0
Joists	ton	17	10	0	to	18	10	0
Plates	ton	20	10	0	to	21	10	0
Rails, heavy	ton	16	10	0	to	16	15	0
Sheets, 24 G. black	ton	24	10	0	to	24	15	0
Sheets, galvanised corrugated	ton	32	10	0	to	33	0	0

Building Materials

Bricks, stock	1000	3	16	0	to	3	17	0
Bricks, blue Staffs	1000	9	3	0	to	9	5	0
Firebricks, Stourbridge	1000	10	9	0	to	10	12	0
Fireclay, Stourbridge	ton	2	2	0	to	2	3	6
Glass, sheet, 21oz.	ft.	0	0	8½	to	0	0	8¾
Lime, ground blue Lias	ton	2	10	0	to	2	10	0
Lime, grey stone	ton	2	15	0	to	2	15	0
Linseed oil, boiled	gall.	0	11	6	to	0	12	6
Linseed oil, raw	gall.	0	11	0	to	0	11	6
Portland cement	ton	3	14	0	to	3	16	0
Slates, Bangor	1200	32	0	0	to	34	10	0
Slates, Portmadoc	1200	18	10	0	to	21	10	0
Tiles	1000	6	5	0	to	6	10	0
Turpentine	gall.	0	11	0	to	0	11	3
Yellow pine up to 3×8	standard	40	0	0	to	55	0	0
Yellow pine over 3×8	standard	45	0	0	to	60	0	0

Company News

ANGLO-CONTINENTAL GUANO WORKS.—Interim dividend of 12½ per cent. per annum on the ordinary shares.

BERNAM-PERAK RUBBER.—Further dividend of 6 per cent. on the ordinary shares for the year ended June. For 1917–18 there was no distribution on either class of shares.

BROKEN HILL PROPRIETARY BLOCK 14.—Interest at the rate of 10 per cent. per annum on the preference shares for the six months ending September 30 (less tax), payable on that date.

BULLOCK, LADE & CO. LTD.—At the annual meeting in Glasgow, Sir John Archer presiding, said that after paying dividends amounting to 20 per cent. on the ordinary shares for the past year, adding £10,000 to depreciation fund, £10,000 to the insurance fund, and £20,000 to the reserve (raising that fund to £170,000), they were carrying forward £12,815. The embargo on distillation was removed about the middle of last January, but owing to shortage of barley and scarcity of labour, many distilleries were unable to make a start. Work would be resumed at all the company's distilleries in the early autumn, but the cost of production would be very high owing to very dear barley and enhanced prices of coal and other materials. The report was adopted.

CANADA IRON FOUNDRIES, LTD.—A general meeting of the 6 per cent. "B" debenture stockholders of the Canada Iron Foundries, Ltd., was held to consider proposals for the conversion of the stock, the proposal being to exchange it for cash and preferred shares at the rate of £45 in cash and $300 in preferred shares for each £100 of "B" stock. The resolutions were carried by votes representing £337,830 of stock, there being only £16,600 against them.

COR FOBA COPPER.—It is stated in a circular to the shareholders that negotiations have been completed for the sale, with the consent of the Board of Trade, of all the Company's property in Spain for a sum of 1,000,000 pesetas, payable in cash. The total assets of the company are now represented by a sum of approximately £70,000 invested in Government securities.

DALMELLINGTON IRON.—A final dividend on the ordinary shares of 6s. 3d. per share, free of tax, making 10 per cent. for the year, the same as last year.

DOLOK RUBBER ESTATES.—Year's profit £26,304, as compared with £28,538, and with £21,375 brought forward, there is available £47,679, against £32,852. Dividend of 10 per cent. against nil; to reserve £10,000, against £8,000; forward £17,679. The last dividend was 7½ per cent. for 1916.

GENERAL OILFIELDS.—At an extraordinary general meeting last week a resolution was unanimously approved for the increase of the company's capital to £105,000.

RAYFIELD (NIGERIA) TIN MINES.—A circular just issued to the shareholders states that arrangements have been completed for the amalgamation of the New Lafon properties with those in the Kassa Ropp and Yelwa areas, and for the acquisition of the remaining interest in the West African Mines properties.

ROUMANIAN CONSOLIDATED OILFIELDS.—Advices from Roumania, dated Aug. 20, state that the general strike in the petroleum industry has come to an end, and that all the employes have now returned to work.

RUSSIAN OIL AMALGAMATION.—Special meetings of the Baku Russian Petroleum, the Bibi Eibat, the European Oilfields, and the Russian Petroleum Companies were held in London on Tuesday, when liquidation in order to carry out the amalgamation plan was resolved upon. Mr. H. Allen, who presided, said the new company had already been registered under the title of Baku Consolidated Oilfields (Ltd.), and has an authorised capital of £2,500,000, in shares of £1 each. Half of these shares will be entitled to a preferential dividend of 8 per cent., and will be called A shares, the other half will be called B shares, and after they received 8 per cent. in any year both classes of shares will rank equally. Shareholders in the four existing companies will get the £1 A shares at 17s. 6d. each. The new company will have from 12,000 to 15,000 shareholders, and with the possible exception of the Shell Company will be the largest British oil company in existence.

SAN MIGUEL COPPER MINES.—At an extraordinary general meeting of the San Miguel Copper Mines, Ltd., it was resolved to wind up the company voluntarily, with Mr. E. Johnston, the secretary, as liquidator. Mr. C. A. Massaouti, who presided, explained the difficulties under which the company had been carrying on its operations owing to the scarcity of freight, the great increase in working costs, and the fact that the ore mined had been steadily deteriorating in value.

SCOTTISH IRON AND SEEL.—An interim dividend for the past half-year of 3 per cent actual on the ordinary shares, the same as a year ago.

UNITED STEEL COMPANIES, LTD.—At the annual general meeting a final dividend was declared of 10 per cent. per annum. The chairman, Mr. Harry Steel, in the course of his remarks, said his knowledge of the steel trade extended over nearly forty years, and during that time the average price for a steel article had been anything from £5 to £6 a ton. To-day the average price was £15 or £16. The average price of pig-iron had been £3 to £3 10s., but to-day it was 10 guineas.

Stocks and Shares

Commercial, Industrial, &c.

	Quotations Aug. 27.	Sept. 3.
Alby United Carbide Factories, Lim., Ord.	27/32–31/32	13/16–15/16
Associated Portland Cement Manufrs. (1900.) Lim., Ord.	9⅜–9⅝	9⅜–9⅝
Bell's United Asbestos Co., Lim., Ord.	2–2¼	2 1/16–2 5/16
Bleachers' Association, Lim., Ord.	1 7/16–1 9/16	1 13/32–1 15/32
Borax Consolidated, Lim., Prefd. Ord.	4⅛–5	4⅛–5
Bradford Dyers' Assoc. Lim., Ord.	2 1/16–2 7/16	2 5/16–2 5/16 xd
British Aluminium Co., Lim., Ord.	1 9/16–1 11/16	1 9/16–1 11/16
British Oil and Cake Mills, Lim., Ord.	2 13/32–2 15/32	2 3/32–2 9/32 xd
British Portland Cement Manufrs., Lim., Ord.	33/6–35/6	33/6–35/6
Brunner, Mond & Co., Lim., Ord.	2–2 1/16	40/6–41/6
Castner-Kellner Alkali Co., Lim.	2⅛–2⅞	2⅛–2⅞
China Clay Corporation, Lim., Ord.	¼–⅜	¼–⅜
Cook (Edward) & Co., Lim., 4% 1st Mort. Deb. Stock Red.	57–61	57–61
Courtaulds, Lim.	9¾–10¼	10¼–10¾
Crosfield (Joseph) & Sons, Lim., Cum. 6% Prefce.	⅞–1⅛	⅞–1⅛
Curtis's & Harvey, Lim.	2 9/16–2 13/16	2 9/16–2 13/16
Electro Bleach and By-Products, Ltd., 7% Pref.	20/10½	.. ..
Explosives Trades, Lim., Ord.	20/6–21/6	20/9–21/9
Field (J. C. & J.), Lim., Ord.	7/16–9/16	7/16–9/16
Greenwich Inlaid Linoleum (Fredk Walton's New Patents) Co., Lim., Ord.	½–⅝	½–⅝
Harrisons & Crosfield, Lim., 10% Cum. Prefd. Ord.	1 31/32–1 15/32	1 31/32–1 15/32
India Rubber, Gutta Percha and Tel. Wks. Co., Lim., Ord.	16¾–17¼	16½–17½
Lawes' Chemical Manure Co., Lim., Ord.	6–6½	6–6½
Lever Bros., Lim., 6% Cum. "A" Pref.	19/9–20/3	19/7½–20/1½
Do. 6½ % Cum. "B" Pref.	19/10½20/4½	19/10½20/4½
Magadi Soda Co., Lim., Ord.	1 1/16–1 3/16	1 1/16–1 3/16
Manganese Bronze and Brass Co., Lim., Ord.	11/16–13/16	11/16–13/16
Maypole Dairy Co., Lim., Defd. Ord.	27/32–29/32	27/32–29/32
Mond Nickel Co., Lim., 7% Cum. Pref.	1–1⅛	1–1⅛
Do. 7% Non. Cum. Pref.	15/16–1 1/16	15/16–1 1/16
Pacific Phosphate Co., Lim., Ord.	5⅛–5⅜	5⅛–5⅜
Power-Gas Corporation, Lim., Ord.	⅜–7/16	⅜–7/16
Price's Patent Candle Co., Lim.	52–55	50–53
Salt Union, Lim., Ord.	1 31/32–1 15/32	1 13/32–1 17/32
United Alkali Co., Lim., Ord.	1¼–1⅜	1¼–1⅜
Val de Travers Asphalte Paving Co., Lim.	31/32–1 3/32	31/32–1 3/32
Van den Berghs, Lim., Ord.	3 3/16–3 7/16	3 7/16–3 11/16
Walkers, Parker & Co., Lim.	1 5/8–1¾	1 3/16–1 5/16
Welsbach Light Co., Lim.	2¼–2½	2¼–2½

Gas, Iron, Coal and Steel

Armstrong (Sir W. G.) Whitworth, Ltd., Ord.	39/0–40/0	37/6–38/6
Ebbw Vale Steel, Iron & Coal Co., Lim., Ord.	1¼–1 5/16	1¼–1 5/16
Gas Light and Coke Co., Ordinary Stock (4% Stand.)	53/0–56/0	56–59
Hadfield's, Limited, Ordinary	39/6–40/6	39/6–40/6
South Metropolitan Gas Co., Ordinary (4% Stand.)	53/0–56/0 xd	57–60
Staveley Coal & Iron Co., Lim., Ord.	1 7/8–2	1 13/16–1 15/16
Vickers, Limited, Ordinary	37/0–38/0	36/0–37/0

Mines, Nitrate, &c.

Anglo-Chilian Nitrate and Rly. Co., Ltd., Ord.	13½–14	13–14
Antofagasta Nitrate Co. Compañia de Salitres de Antofagasta) 5½% 1st. Mt. Debs. Red.	88–93	88–93
Lagunas Nitrate Co., Lim.	1–1¼	1–1¼
Rio Tinto Co., Lim., Ord. (Bearer)	54/0–56/0	54–56
Tarapacá and Tocopilla Nitrate Co., Lim.	14/0–15/0	14/0–15/0

Oil and Rubber

Anglo-Java Rubber & Produce Co., Lim.	6/4½–6/10½	7/9–8/3
Anglo-Maikop Corporation, Ltd., Ord.	5/0–6/0	5/0–6/0
Anglo-Malay Rubber Co., Lim.	13/4½13/10½	14/7½–15/1½
Anglo-Persian Oil Co., Lim., Cum. 6% Part.	1 9/32–1 11/32 xd	1 9/32–1 11/32
Burmah Oil Co. Ltd., Ord.	13 13/16–14 1/16	13 7/16–13 11/16
Chersonese (F.M.S.) Estates, Lim.	3/10½–4/1½	4/1½–4/4½
Mexican Eagle Oil Co., Lim. (Cia Mexicana de Pet. "El Aguila" S.A.) Ordinary	8 11/16–8 23/32	8 11/32–8 7/32
"Shell" Transport and Trading Co., Lim., Ord.	8 7/16–8 9/16	8 7/16–8 9/16
Do. 5% Cum. Pref.	9⅜–9⅝	9⅜–9⅝

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

LONDON GAZETTE

Partnerships Dissolved

SCHOFIELD, Taylor, and WHEATLY, Albert Edward, importers, manufacturers and pastrycooks' sundriesmen, 47 to 51, Heath Street, Liverpool, Lancs., under the style of The Confectioners' Colour and Essence Company, by mutual consent as from August 15, so far as concerns Taylor Schofield, who retires from the firm. All debts received and paid respectively by Albert Edward Wheatly, who will carry on the business under the same style at the same address.

HEMS, William Benjamin, and MONFOO, Charles Yow, oil and colourmen, &c., 45, West India Dock Road, Poplar, under the style of W. Hems & Co., by mutual consent as from July 26. All debts received or paid by Charles Yow Monfoo, who will carry on the business.

Liquidators' Notices

PETROL SUPPLY COMPANY, LTD.—A general meeting of members will be held at 3, Copthall Buildings, London, E.C., on Monday, September 29, at 12 noon. Cecil E. Gooding, liquidator.

THE PREMIER OIL AND PIPE LINE CO., LTD.—A meeting of creditors will be held at the Institute of Chartered Accountants, Moorgate Place, E.C. 2, on Monday, Sept. 15 at 11 a.m. H. J. De C. Moore, liquidator.

THE CRAVEN LIME COMPANY, LTD.—(In voluntary liquidation.) A general meeting of members will be held at the office of Ford & Warren, 61, Albion Street, Leeds, on Tuesday, October 7, at 1.45 p.m. Geo. H. Archer, liquidator.

THE ACETYLENE EQUIPMENT COMPANY, LTD.—A meeting of creditors will be held at Palmerston House, Old Broad Street, E.C. 2, on Wednesday, September 10, 1919, at 3 p.m. J. Gibson Harris, liquidator.

Companies Winding up Voluntarily

SUGAR AND MALT PRODUCTS, LTD.—(Winding up voluntarily for reconstruction purposes.) A meeting of creditors will be held at 97, Carpenter's Road, Stratford, E., on Monday, September 8, 1919, at 2 p.m. F. M. Roberts, liquidator.

ST. ANTHONY'S OIL PRODUCTS, LTD.—Mr. Arthur Edwards Sells, of Tonbridge, appointed liquidator. Meeting of creditors at 31, Throgmorton Street, London, E.C., on September 5.

Mortgages and Charges

[*NOTE.—The Companies Consolidation Act of* 1908 *provides that every Mortgage or Charge, as described therein, created after July* 1*st*, 1908, *shall be registered within* 21 *days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges which would, if created after July* 1, 1908, *require registration. The following Mortgages and Charges have been so registered. In each case the total debt, as specified, in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced since such date.*]

ANGLO-COLONIAL DYES, LTD., LONDON, E.C.—Registered August 19, £7,365 9/8 deb., to A. E. Percival, 21, Lawrence Lane, E.C., merchant; general charge, including machinery, plant, &c. *Nil. December 31, 1918.

ATLAS METAL & ALLOYS CO., LTD. (formerly the ATLAS SMELTING CO., LTD.), LONDON, E.C.—Registered August 19, memorandum of deposit for securing all moneys due or to become due, to the National Provincial and Union Bank of England, Ltd. charged on freehold land and buildings, at Hertford Road, Barking.

BRITISH VEGETABLE OIL EXTRACTION CORPORATION, LTD., LONDON, E.C.—Registered August 20, mortgage or charge for securing all moneys which may be advanced by the mortgagees or which they may procure to be advanced, not exceeding £25,000, to W. P. Bonbright & Co., 16, George Street, Mansion House, E.C.; charged on freehold land and hereditaments, &c. at Edmonton and Chingford, also a general charge, &c. *£150,000. December 3, 1918.

ELSTREE CHEMICAL WORKS, LTD., LONDON, E.C.—Registered August 25, £2,000 debentures, part of £15,000; general charge.

GREENWICH STEEL & IRON WORKS, LTD., LONDON, E.C.—Registered August 20, £6,000 debentures (filed under Sec. 93 (3) of the Companies (Consolidation) Act, 1908), present issue, £4,000; general charge.

MILLOM & ASKAM HEMATITE IRON CO., LTD., MILLOM.—Registered August 19, trust deed dated August 1, 1919, for securing £132,900 5 per cent. first mortgage debenture stock, with authority to increase up to £1,000,000; charged on various freehold and leasehold hereditaments, also a general charge.

PILBARA COPPER FIELDS, LTD., LONDON, E.C.—Registered August 25, £5,000 debentures balance of £20,000; general charge. *£57,760. Dec. 31, 1918.

QUEENSBOROUGH GLASS BOTTLE WORKS, LTD., LONDON, E.C.—Registered August 22, £4,000 mortgage to the Queensborough Contracting Co., Ltd., Queensborough (Kent); charged on land at Queensborough (Kent). *———. January 18, 1918.

V.C. GLASS MANUFACTURING CO., LTD., NEW SOUTHGATE, N.—Registered August 25, mortgage or charge for securing £600 and further advances not exceeding £2,000 to E. D. Parsons, 30, Coleman Street, E.C., shipping and general merchant; charged on equity of redemption in land and buildings in or near Bounds Green Road, Wood Green, and plant and machinery upon said premises, also a general charge. *Nil. December 31, 1918.

New Companies Registered

The following list has been prepared for us by Jordan & Sons, Ltd., company registration agents, 116 and 117, Chancery Lane, London, W.C.:—

M. H. WILSON & SONS, LTD.—To acquire and carry on the business of manufacturers of chemical manures and coal merchants. Nominal capital, £40,000 in 40,000 shares of £1 each. Directors: Mary H. Wilson, 12, South Bank, Wisbeck; F. W. Wilson, Clarkson-avenue, Wisbeck; Grace Burgis. Qualification of Directors, £100. Remuneration of Directors £50 each. Chairman £150.

STOCKPORT UNITED CHEMICAL CO., LTD., Old Road Works, Stockport, Chester.—To acquire and carry on the business of Chemical manufacturers. Nominal capital, £25,000 in 20,000 Ordinary shares and 5,000 Preference shares of £1 each. Directors: S. Johnson, Peking House, Heaton, Chapel; B. E. Johnson, Peking House, Heaton, Chapel, Governing Directors. Qualification of Directors, 1,000 Ordinary shares, Governing Directors. Remuneration of Directors, £500 each Governing Director.

TUDO-BURMA OILFIELDS, LTD.—To acquire and develop oil-bearing lands. Nominal capital £100 in 100 share of £1 each. Directors: To be appointed by subscribers. Qualification of Directors 5 shares. Remuneration of Directors to be voted by company in general meeting. Subscribers: E. M. Gardner, 96, Lansdown Road, Holland Park, W.; A. H. Palmer, Melville House, Green Lanes, Palmers Green, N.

VICTORIA INDUSTRIAL LABORATORY, LTD., 36, High Street, Chorlton-on-Medlock, Manchester.—Analytical and consulting chemists. Nominal capital £1,000 in 1,000 shares of £1 each. Directors: J. T. Blundell, 320, Union Road, Oswaldtwistle; A. L. Burlin, 36, High Street, Chorlton-on-Medlock. Qualification of Directors £50.

DICK'S ASBESTOS COMPANY, LTD., 47, Fenchurch Street, E.C. 3. Nominal capital £100,000 in 50,000 Preference shares of £1 and 50,000 Ordinary shares of £1. Directors: W. F. Dick, Josselyns, Little Hawksley, Essex (Governing Director); A. R. Williams, 17, Woodhouse Road, Leytonstone, Essex; L. L. Martlock, 139, Overhill Road, Dulwich, S.E. 22. Qualification of Directors £1. Remuneration of Directors £100 each, Governing Director £1,000.

M. GROSSE & CO., LTD., 54 and 56, Berry Street, Liverpool.—Chemists, druggists, perfumers, &c. Nominal capital £10,000 in 10,000 shares of £1 each. Minimum subscription £1,000. Directors: M. Grosse, 22, Ashbourne Road, Aigburth, Liverpool; J. W. Hawly, 216, Aigburth Road, Liverpool. Qualification of Directors 100 shares.

AVI-CALCIUM, LTD.—Manufacturers and dealers in articles of all descriptions made or prepared with india rubber or inflated with gas or air. Nominal capital £50,000 in 240,000 shares of 5s. each. Directors: C. A. Cleghorn, Brackenside, Woburn Sands, Beds.; C. W. Bradley, 107, Kenilworth Court, Putney, S.W.; A. Davis, Elworth, Claygate, Surrey. Qualification of Directors 100 shares. Remuneration of Directors £100 each, Chairman £150.

OSBORNE'S (CHEMISTS), LTD., Medical Pharmacy, St. John Street, Ashbourne, Derby.—Chemist and druggist. Nominal capital £2,000 in 2,000 shares of £1 each. Directors: J. M. Williams, Medical Pharmacy, Ashbourne; Louisa R. Williams, Medical Pharmacy, Ashbourne. Qualification of Directors 1 share.

REDMIRE LIMESTONE QUARRY COMPANY, LTD., Redmire, York.—To acquire quarries, or deposits of limestone, freestone or other stone and turn same to account. Nominal capital £15,000 in 15,000 shares of £1 each. Directors: J. R. Stringer, Calvert, Redmire, Yorkshire; D. R. Stringer, Calvert, Redmire, Yorkshire; W. Hartley, Calvert, Redmire, Yorkshire; R. White, Calvert, Redmire, Yorkshire; W. G. Urwin, 26 Marion Road, Middlesbrough. Qualification of Directors £500.

JOSHUA KERSHAW & SONS, LTD., Blackhorse Street, Bolton.—Tanners, curriers, leather dressers, leather belting and roller leather manufacturers. Nominal capital £20,000 in 20,000 shares of £1

each. Directors: J. Kershaw (Managing Director), R. J. Kershaw. Qualification of Directors 1 share.

BIRMINGHAM PHOSPHORISING AND ALLOY CASTING COMPANY, LTD., 6, Berkeley Street, Birmingham.—Smelters, melters down, manufacturers and dealers in brass, ingots of brass, and other alloys, &c. Nominal capital £10,000 in 10,000 Ordinary shares of £1 each. Directors: G. E. Hunt, W. E. Moist. Qualification of Directors 500 shares.

COLOUR OXIDISING COMPANY, LTD.—Electro-platers, chemists, &c. Nominal capital £8,000 in 2,000 Preference shares of £1 each and 6,000 Ordinary shares of £1 each. Directors: to be appointed by subscribers. Qualification of Directors £10. Remuneration of Directors £50 each, Chairman £75. Subscribers: R. G. Davies, Alderman's House, Bishopsgate, E.C.; A. Roe, Alderman's House, Bishopsgate. E.C.

SOUTHDOWN CHEMICAL COMPANY, LTD., Beaufort Road, Birkenhead, Chester.—Chemical manufacturers, makers of dyes, and drugs of all kinds. Nominal capital £60,000 in 60,000 shares of £1 each. Directors: R. M. Downie (Chairman), G. E. Southcombe. Qualification of Directors, other than First Directors, 100 shares.

SELBY CHEMICAL COMPANY, LTD., The Holmes Works, Holme Lane, Selby.—Chemical, colour and dye manufacturers. Nominal capital £55,000 in 55,000 shares of £1 each. Directors to be appointed. Qualification of Directors £100. Remuneration of Directors to be voted by company in general meeting.

In our issue last week the address of Messrs. Hovey & Lowther, Ltd., manufacturers of phosphate products, was given as Sunderland, Cheshire, instead of Sandbach, Cheshire.

A Substitute for Petrol

IN the matter of J. Mackenzie O'Brien, 10, Rydal Road, Streatham, Surrey, a receiving order was made on a creditor's petition, the act of bankruptcy being the debtor's non-compliance with the requirements of a bankruptcy notice which had been duly served upon him in March last. The statement of affairs shows liabilities ranking at £13,725 9s. 8d., and assets estimated to produce £4,774 9s. 11d., after allowing for the claims of preferential creditors, the estate thus showing on paper a deficiency of £8,950 19s. 9d. On December 6 1916, the debtor granted to a limited company a licence to manufacture a liquid substitute for petrol, which he had used about 1912, and which he patented. He reserved a royalty of 3d. per gallon, with a guaranteed minimum of 1,250 gallons per week; he thus became entitled to monthly payments of £60 in addition to a salary of £10 per week as technical adviser to the company. In May, 1918, he charged his royalty to secure a loan of £900, which has now been reduced by receipt of the monthly payments to £300. On January 27, 1919, in consideration of £50 cash paid, he granted an option to purchase for £5,000 within eighteen months, his rights in the British patent of the Lightning Motor Fuel.

Oatos Compound Meals Co., Ltd.

A PETITION for the winding-up of the above-named company by the High Court of Justice was, on August 13, presented to the Court by John Aloysius O'Loughlin, of Homelea, Brighton Grove, Rusholme, Manchester, bleacher, dyer and finisher, and managing director, a creditor of the company, and the petition is directed to be heard before the Court at the Royal Courts of Justice, Strand, London, on Tuesday, October 14.

The Affairs of Perry, Mills & Co.

THE first meeting of the creditors of Perry, Mills & Co., Capel House, New Broad Street, E.C., chemical merchants and exporters, was held at the London Bankruptcy Court on August 29, Mr. F. T. Garton (Official Receiver) presiding. The Chairman reported that the liabilities were roughly estimated at £11,000; the value of the assets had yet to be ascertained. The members of the firm were J. A. H. Duke and H. Slater. It appeared from the statements of Mr. Duke that from 1908 to 1912 he was managing director of the Oil Refiners, Ltd., and had since continued to act as a director of that company. In 1912 he started business in partnership with a Mr. Petty, at 29, Gracechurch Street, E.C., under the style of Perry, Mills & Co. They secured several agencies for German firms and worked up a successful business; but, upon the outbreak of war, they lost a considerable part of it. In September, 1917, Mr. Petty withdrew from the firm, and Mr. Duke continued the business alone, but under management. Mr. Slater became a partner in September, 1918, and introduced £700 capital. The firm dealt chiefly in chemicals which were exported to the Continent. They had several large contracts with Italian firms who, on the signing of the armistice, refused to take further deliveries, on the ground that the armistice cancelled all existing contracts. The debtors now had pending claims against two Italian firms for £14,800. They attributed their failure entirely to the action of their clients on the Continent in relation to contracts entered into before the armistice.

A resolution was passed for Mr. Claude L. Sixsmith, C.A., 6, Broad Street Place, E.C., to act as trustee and wind up the estate in bankruptcy, with the assistance of the following committee of inspection, viz., Mr. C. Hadfield (The Nippon Shoko Co., Ltd.); Mr. R. A. Giles (Brimsdown Lead Co.), and Mr. W. R. Livesay (Riley & Son, Ltd.). The bond to be given by the trustee was recommended to be for £2,000.

Future of Oil Fuel

Liverpool as a Distributing Centre

IT is reported that as soon as constructional difficulties have been surmounted, Liverpool is to be equipped with vast oil storage facilities, enabling it to supply the requirements both of the great fleets of steamers which will be burning liquid fuel in the near future and mechanical plant in manufactories. These facilities will be provided, probably at the south end of the city, by the British Union Oil Company, a syndicate promoted by Lord Inverforth, Lord Pirrie, Sir Thomas Royden, M.P., and others interested in ensuring supplies of oil to some of the biggest ocean fleets of the world.

The company, whose shares are not purchasable by the general public, has a capital of £2,000,000, one million of which is taken up by Americans directly concerned in oil production. The primary purpose of the company is not to produce oil, but to transport, distribute, and merchant it in Europe. The scheme was first mooted, and in part formulated, in 1913 and 1914, but the war prevented developments along the lines originally contemplated.

"The only possible limiting factor in the great future of oil for fuel purposes," remarked Sir Thomas Royden, in speaking of the scheme, "is the quantity available. Oil-burning, both on steamers and in industrial undertakings ashore, is the great thing we have to consider now—not only in England, but in every country. Very big strides have been made of late years in the adaptation of engines for the burning of oil; it is not anything like the expensive business it was formerly. In the old days it was both difficult and costly to use oil fuel for large boilers, but it is not so now. Oil fuel is particularly adapted for use in water-tube boilers; steam is generated very rapidly. There can be no doubt in the minds of anyone that the ideal arrangement for the generation of steam is water-tube boilers with oil-fuel consumption—a condition of things which you find on our battleships. Besides that, the old trouble of leaky boilers, due in most instances to the uneven distribution of the heat, will be reduced to an aboslute minimum, if not entirely abolished, when oil comes into its own aboard steamers. We are only beginning to realise what oil-burning will mean as a matter of economy compared with the present dearness of coal and the possible higher price yet to come."

SHEEPBRIDGE COAL & IRON.—Dividend of 5 per cent. on all shares, making 10 per cent. for the year, free of tax. For 1917–18 the dividends were 12½ per cent. Last December the capital was increased, and it was decided to capitalise reserves amounting to £334,631, bonus share to that amount being given.

For Sale or Wanted

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M.A.A.